ELECTRICAL REVIEW

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VIEWS, NEWS AND INTERVIEWS.

As every one knows, the wire and cable manufacturers have been for some time and are still working day and night to supply the government with cable. Two wire salesmen for rival companies met the other day and one said:

"Hooray for war!"

"No," said the other, "hooray for war preparations!"

The Maryland House has concurred with the Senate, by a vote of 56 to 22, in appropriating $50,000 a year for two years to Johns Hopkins University at Baltimore.

It is said to be probable that in a short time travel by successive trolley tracks will be possible from Portland, Me., to Providence, R. I., a distance of 222 miles. Michigan has 165 miles of trolley tracks, with 800 more projected or under discussion, and one of its single stretches of proposed line is 90 miles long.

An alternating-current station is to be installed for the Lewiston Light Company, of Lewiston, Ida. The plant is to be located on Asotin Creek, 10 miles above Lewiston, and will be run by water-power.

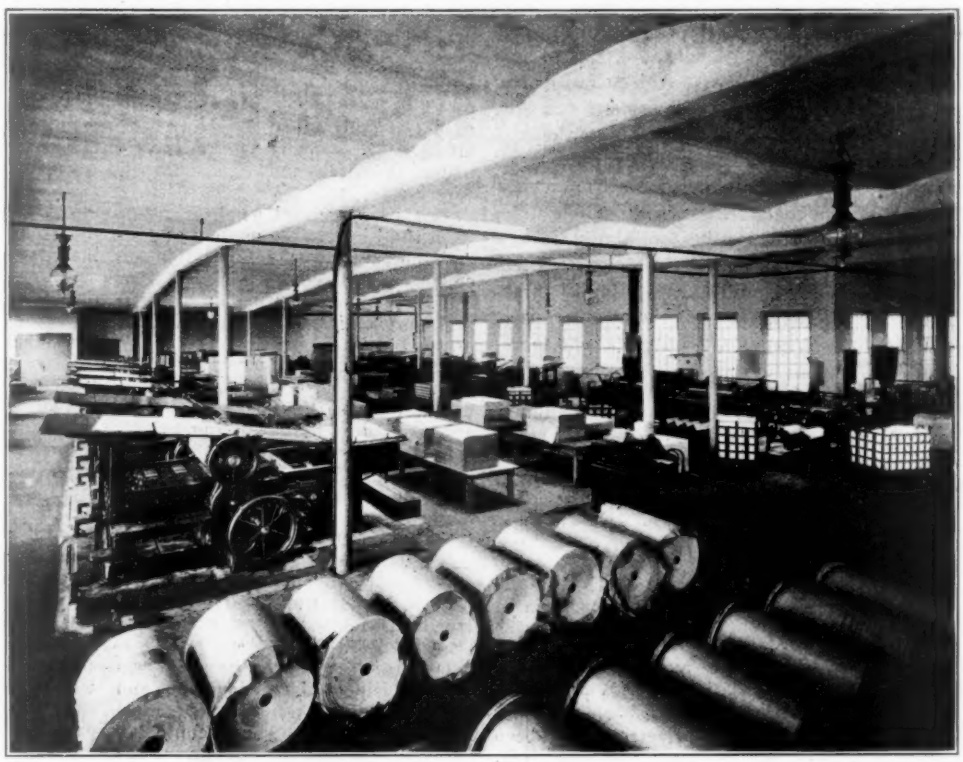

FIG. 1.—A MODERN PRESS-ROOM SHOWING EACH PRESS EQUIPPED WITH AN INDEPENDENT ELECTRIC MOTOR. NO BELTING OR SHAFTING IN SERVICE. (See page 245.)

It has been stated that the diving operations about the sunken "Maine" in Havana Harbor were greatly facilitated by the use of sub-marine telephones, by which each diver had a constant means of communication with his helpers at the surface.

New Haven and New England railroad officials declare that the third-rail system of electric locomotion is a great success. The New Haven Railroad has decided to extend its Nantasket Branch line eight miles to Braintree, Mass., and the New England Railroad is to extend its New Britain line to Bristol, Ct. The New Haven and New England railroads have planned to operate the third-rail system on a circuit via Hyde Park and Dedham, Mass., when the new union station is completed. It is estimated that this will greatly decrease the cost of operation.

The Flushing, L. I., Electric Light Company was robbed the other night of 18,000 feet of new copper wire. The company has a contract to extend its lines to Jamaica and Bay Side. The wire was strung on the poles, but the lamps had not been installed. The thieves cut the wire close to each pole.

The governing board of the Sheffield Scientific School, of Yale University, has established six new scholarships of $100, the equivalent of remitted tuition for the same number of students.

At a meeting last week of representatives of the surface trolley lines using the Brooklyn Bridge statements were submitted by Commissioner Shea showing the decline in revenue for the month of March, and by representatives of the trolley lines giving their argument. None of the elevated lines was represented as they were not invited, and will not be until they have been in operation a sufficient period to determine whether the rate of 12½ cents per car is equitable. The meeting adjourned with the understanding that the Brooklyn Rapid Transit Company will submit a statement showing the actual cost to operate the cars across the bridge as well as the increased receipts and expenses. When this is submitted to Commissioner Shea he will then ask for another conference.

The proposed amalgamation of Harvard University and the Massachusetts Institute of Technology has been the subject of conferences between committees of both institutions, but the plan has now been abandoned.

THROUGH ENGLISH EYES.

NOTES ON ELECTRICAL MANUFACTURE IN THE UNITED STATES.

TO THE EDITOR OF ELECTRICAL REVIEW:

To ascertain the developments and trend of American electrical engineering, the writer, an English engineer, recently paid a visit to the States, and was fortunate in being enabled to visit the chief electrical shops and several of the large light and power stations in and around New York, Boston, Pittsburgh, Schenectady and Cleveland. The ground covered was limited by the time at disposal, five weeks, so that only a general survey was possible.

The two firms that have like the kine of Pharaoh's realm, swallowed up most of their rivals, either by absorption or amalgamation, are the well known General Electric Company, of Schenectady, N. Y., and the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa. Both are mammoth concerns, employing several thousand hands, and apparently extremely flourishing, as between them they monopolize a large proportion of the business. Although under entirely separate management these two firms have a working arrangement where their patent interests conflict. Having regard to the costliness and uncertainty of patent litigation this is undoubtedly a wise policy. Next in importance are the Walker Company, of Cleveland, Ohio, and the Stanley Company, of Pittsfield, Mass., both enterprising firms, building heavy machinery, and the Crocker-Wheeler Company, of Ampere, N. J., and the Bullock Manufacturing Company, of Cincinnati, Ohio, are very advanced in the smaller class of plant. As in Eng-

land, by far the greater portion of electric lighting and power has been carried out on the direct-current system. An enormous demand for the continuous current has been created by the rapid growth of electric traction stations, which have sprung into existence during the last five years in every town of importance throughout the vast territories under the Stars and Stripes. Out West, however, the abundant water-powers, frequently at some distance from industrial centers, have given an impetus to long-distance transmission, and the alternate current is there forging ahead and bids fair to eventually oust its rival. But for power and light distribution in restricted areas, such as factories, multiphase plants are comparatively rare, whereas, on the Continent of Europe, and especially in Germany and Switzerland, the biphase and triphase machines are in common use, and are being manufactured by such firms as Schuckerts, Brown Boveri, the Allgemeine Gesellschaft of Oerlikon by the thousand.

The General Electric company employ over 4,000 hands at their Schenectady works, which comprise a series of detached sheds, each department being located in its own buildings, with distinct staff, under the able direction of Mr. Rice as general manager and Mr. Steinmetz as chief electrician.

The shops are lofty, well lighted, and largely electrically driven by direct-current motors. The armature disk-stamping department is especially well equipped with modern presses, notching machines and an ingenious varnishing and drying machine, which accomplishes the double process at as rapid a rate as it can be fed with the disks. These are passed through a varnish trough, between rubber rollers, then carried over a hot blast, and finally deposited in piles ready for the armature builders. Traction plant is much in evidence; in fact, at present is the *piece de resistance* at Schenectady. The generators, with heavy polar rings, large diameter slotted armatures, commutators and massive shafts, are to be seen in every stage, and are fine examples of their class. The car motors have four-pole fields, hollow armature cores and commutators, securing good ventilation and long-bearing surfaces with a minimum overall length of shaft. The armature binders are sunk in grooves flush with the core face. The coils are former-wound, and the number of slots is less than the number of coils. Smooth cores and stranded bars, which are the rule in England, seemed almost extinct in American designs, though, curiously enough, the writer was informed that one of the chief firms in the States is reverting to this design. Truly there is no accounting for electrical vagaries. In the case of a 12-pole, 1,500 kilowatt generator—the largest traction unit seen by the writer—the current per conductor only averages 220 amperes, so that the solid copper armature bar is of manageable dimensions. The commutators are solid drawn copper in the large machines and drop forged in the smaller ones, mounted in cast-iron sleeves. The divided hinged fields for trolley car motors are giving place to a newer design, with detachable end plates of larger diameter than the armature, so that the latter can be withdrawn sideways, the argument in favor of this arrangement being that if the armature breaks down it must be removed for repair, and is as readily extracted endways as from below, and a more symmetrical field configuration is obtainable.

Carbon brushes are almost invariably employed. The shiplighting sets approximate closely to English practice, but, even in the smaller sizes, the dynamos are multipolar, and therefore lighter; but the head-room required by the engine is greater than with bipolar dynamos. The engines are single-cylinder, vertical, double-acting, having side-by-side piston valves, the outside an auto-expansion one controlled by flywheel governor.

The Westinghouse Electric and Manufacturing Company, of Pittsburgh, employ from 4,000 to 5,000 hands, their main shop being 750 feet long—an extremely fine specimen of girder constructional work. To the writer by far the most interesting feature of this company's manufactures was the multiphase plant—biphase and triphase—which both mechanically and electrically has been carried to a high state of perfection. Certainly the machines bear the imprint of that ingeniously simple, substantial engineering design associated with the name of George Westinghouse, while the more subtle electrical portions are the outcome of the genius of Nikola Tesla. Mr. Scott is the present chief of the dynamo designing staff, and, judged by results, a very able one.

The biphase and triphase generators are multipolar with external fixed fields and internal revolving armatures. The poles are of laminated soft steel cast in massive yokes. They appear to be closer together and have less polar area and interpolar gap than is current in English practice. They are compound wound, the compounding current being derived from low-voltage transformer secondaries wound on the spokes of the armature core, and rectified by a commutator attached to armature spindle. The field coils are neatly wound and securely held in position by brass clips. The multiphase motors are of the Tesla induction synchronous squirrel-cage type without collectors, and are turned out in sizes from 3 to 500 horse-power. The largest motors of this character, actually seen running by the writer, were the two in the Niagara Falls Electric Light Company's station. These were biphase, wound for 2,100 volts, and converting energy at the rate of 350 belt horse-power, at 275 revolutions per minute. There is a fascinating simplicity about these motors in striking contrast with the high-tension continuous-current dynamos used for arc lighting in the same station. The Westinghouse starting apparatus for biphase motors is a transformer momentarily inserted in series with the stator windings, and appears to permit of a large range of starting torque. Former winding of armature and field coils has also been highly perfected. Awkwardly curved coils are shaped on wooden spools attached to revolving headstocks. When wound the coils are detached, insulated with micanite, press paper or tape, varnished and dried, and stocked for future use.

The armature coil winding differs from the Eickemeyer method as generally practiced; as in the latter the coil is opened out on removal from the shaping block, whereas a Westinghouse coil is bent to the final shape on the block.

The direct-current generators made by this firm have small polar arcs, magnetically supersaturated pole tips and armature chord winding, which combination, according to the designers, is effectual in eliminating sparking in an armature of 48 inches diameter, an air-gap of one-eighth inch and 600 amperes per pair of poles, not a bad performance, and in agreement with Mr. Mordey's latter-day tenets. But opinions of the electrical world are sharply divided as to sparklessness.

One can not fail to be impressed by the business-like management and well ordered shops of these huge Pittsburgh works. They seem to run just like clockwork. It is a sight worth going a long way to see. Mr. Geo. Westinghouse's activities have had many successful outlets, the latest being a three-crank gas engine. The writer saw one of over 100 indicated horse-power running, direct-coupled to a dynamo supplying current to a bank of glow lamps, whose filaments gave no evidence of that irritating pulsatory light which one associates with a gas engine. A 750-indicated-horse-power engine was under construction.

The Stanley Electric Manufacturing Company, of Pittsfield, Mass., also have a good record in alternating-current work, and have carried out numerous long-distance biphase transmission installations. Their works can not compare in point of size with those just described, but their "system" has been devised with a boldness and originality which has enabled them to steer clear of the Tesla patents.

They build large inductor generators with external staggered poles and rotating drum-shaped armatures with straight conductors. The inductor type is not generally in favor with either American or European designers for inductive loads, such as asynchronous motors, but the Pittsfield firm claim to obtain less lag and drop with their design than would be feasible with the non-inductor generator. They employ condensers, connected across the motor terminals to confine the "idle" current to the motor itself, and regulate the terminal voltage on either of the two phases, though unequally loaded by connecting the line terminals to different points of the generator winding, through a multiple switch. The Stanley motors have staggered-pole stators and straight-bar rotors. A 10-horse-power motor at 100 volts has, when running light, an idle current of four and one-half amperes without condensers, and with condenser this is reduced to less than one ampere.

Another firm well to the front in traction work is the Walker Manufacturing Company, of Cleveland, Ohio. Their shops contain modern tools and turn out large quantities of street railway plant. Their multipolar direct-current generators have laminated steel poles cast into semicircular cast-iron rings, and resemble in general outline those already mentioned. They have the usual slot armatures, large-diameter commutators and appear massive and substantially proportioned.

The Crocker-Wheeler Company represent the lighter side of electrical engineering. Their productions range from the miniature fan motor to dynamos of several hundred kilowatts, which are too well known on both sides of the Atlantic to need description. This firm has new model shops entirely electrically driven, and a large number of the work people are German.

Comparing America with Europe, the former is ahead in street railway work. Repeated failures have evolved sound designs capable of meeting the exacting demands of modern street locomotion. But in the general line of direct-current lighting and power plant, there is not much advance to chronicle. There are differences in construction, some improvements, perhaps, but not startling ones. A number of starting switches and similar devices—some highly ingenious—are on the market, but in many cases somewhat too flimsy and crude to find favor with English electricians. As excessively well thought-out mechanisms, must be cited, however, the car motor controllers and reversers, with magnetic blow-outs. These perform their arduous functions admirably. The essential differences between American and English methods are that the former rely on trial and error; the latter on theory. The American standardizes his goods and manufactures; the Britisher builds more to specification.

K.

London, March 20.

Electrically Driven Printing Presses.

It is probable that no other industrial application of the electric current has advanced so rapidly and so thoroughly as the driving of printing presses by electric motors. The modern press-room is now remarkable for the absence of shafting and belting, and each printing machine is equipped with its own independent motor, either belted or direct-connected. This development has all occurred within the last five years, and its rapidity of growth is due chiefly to the many advantages of electric power as compared with any other form of motive force.

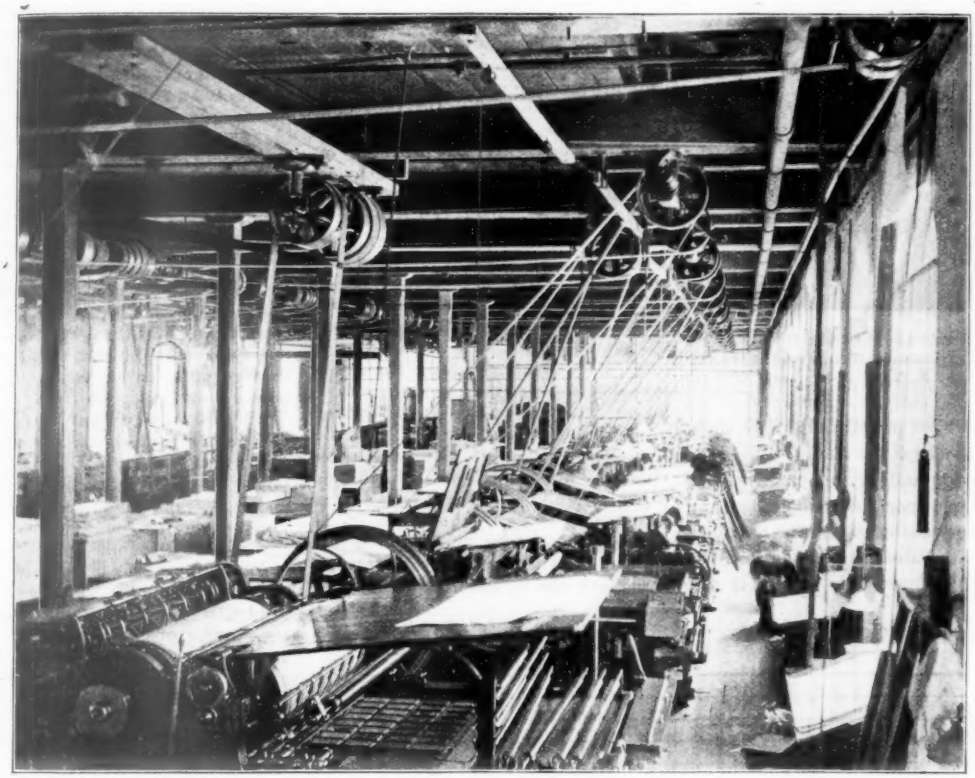

FIG. 2.—AN OLD-FASHIONED PRESS-ROOM, SHOWING BELTING AND SHAFTING.

Among the prominent pioneers in this interesting field are the Sprague Electric Company, of New York city, who have devoted much energy, time and money to the development of the electric motor for this work. A concrete result of their labors in this direction is shown in the two illustrations herewith. Fig. 2 is an interior view in a press-room equipped in the old-fashioned way with shafting and belting. In Fig. 1 is shown a modern press-room, that of the S. S. McClure Company, in New York city, where each piece of machinery is equipped independently with a Lundell motor. The difference in the two methods of distributing power is apparent at a glance. Among the many advantages of electric motors for the operation of printing presses are the following: Saving in power, cleanliness and increased light giving increased product in a given time, decreased danger from fire, economy of space in the press-room, wider range of speed of machines, saving in cost of insurance, elimination of danger to life and limb from belting and shafting, and an increase of product at a decreased cost. An excellent example of these advantages is afforded in the plant of the American Lithographic Company, of New York. That company now employs electric power exclusively, having in use 140 Lundell direct-connected motors, aggregating about 850 horse-power. The management of that company states that the cost of power and light in their new plant per unit of manufactured product is 55.8 per cent of the previous cost, a saving of 44.2 per cent. The American Book Company affords another example fully as striking. Before adopting electric power it cost the American Book Company in their old plant $45 per day for fuel for power alone. At the present time, with a much larger plant and with the added cost of light, heat and elevator service for their plant and for three floors of the University of New York, the cost averages but $8.50, a saving of $36.50 per day. While it is true that there is a variation of the possible savings to be effected by the use of electric motors, owing to the variations of the printing plants themselves, it is probable that there is no instance in which a change to electric power could not profitably be made.

SCIENCE ABSTRACTS.

The following extracts of interest to our scientific readers are from the official publication of the Institution of Electrical Engineers, London, edited by Mr. J. Swinburne:

Viscosity in an Electric Field, G. Quincke—The author has succeeded in demonstrating an increase of viscosity experienced by dielectric liquids in an electric field. Spheres of crown and flint glass, quartz and calcspar, one centimetre in diameter, were suspended by thin silk fibres attached to the arm of a balance. They were immersed in a small trough containing ether, carbon bisulphide, turpentine, benzol, or various mixtures, and surrounded on two sides by condenser plates five centimetres square. The logarithmic decrement of the balance was observed with and without a field due to 2,000 volts. The difference was the electric viscosity normal to the lines of force. This viscosity was 0.0398 in the case of a crown glass sphere in ether, being the difference between 0.0210 and 0.0608. The mean value for CS_2 was 0.0309, and for benzol 0.0256. Parallel to the lines of force the viscosity also increases but to a much slighter extent. In both cases the electric damping is nearly proportional to the difference of potential and the dielectric constant of the liquid.

Schuckert & Company's Arc Lamp—This lamp (German patent, No. 90,945) comprises a rocking frame carrying a train of wheels having, on the first arbor, a drum connected to the movable carbon holder by a cord or wire, and, on the last arbor, a brake-wheel adapted to engage with one arm of a weighted lever which normally rests against a stop in a definite position. The rocking frame rests on horizontal racks by means of toothed wheels so that, as it rocks, it moves laterally, and thus the motion is made smoother by doing away with an axis turning in stationary bearings. To control the motion of this rocking frame, it is provided at its ends with curved surfaces engaging with rollers mounted on the cores of the regulating solenoids.

Rapid Exposures in Radiography, G. Séguy—Coat a thin glass plate with bromide emulsion on both sides. Make two flexible screens of linen, with Becquerel's violet sulphide of calcium suspended in celluloid. Put one of these screens on each side of the coated glass plate, and back both with black card. Put in a frame under pressure. This gives the thorax very clearly in 30 seconds, and other exposures may even be instantaneous.

Type-printing Telegraph—A type-printing telegraphic receiver, called a "telescriptor," the invention of Bernard Hoffman, of Austria, is described. In appearance the instrument somewhat resembles a typewriting machine. Each key on the keyboard is associated with a corresponding bar of a commutator. On the same axle as the commutator is the type-wheel, arranged so that each bar corresponds to a letter or to a figure. This axle also carries ratchet-wheels for controlling and synchronizing the type-wheel. If an earth return is used, only one line wire is necessary. The line current is unidirectional, and the same instrument is available for sending or for receiving. One pole of the line battery is connected to earth; the other is connected to the keyboard, and thence to one or other of the bars of the commutator. From the commutator brush connection is then made through the coil of a relay to line. The local circuit of the relay controls the clockwork that drives the type-wheel; it also actuates an electromagnet for approaching or withdrawing the slip to and from the type-wheel. The instrument is very simple, but its working speed is small; it would seem to have a place between the Hughes printer and the Wheatstone A. B. C. apparatus.

The German Emperor Attends a Lecture On Electrical Radiation.

[*From the Berlin Nachrichten.*]

The Emperor, accompanied by the Empress, the Empress Frederick and a large suite, attended a lecture on "Electrical Radiation" at the electro-technical lecture-room. The lecture was delivered by Professor Slaby, of the Technical High School, and was illustrated by numerous experiments, and by his visit the Emperor again manifested his keen interest in technical science.

After the lecture the distinguished party visited the newly erected electrical laboratory, which received its inauguration by this visit. A number of new electrical inventions and machines were shown and tested. The Emperor was particularly interested in an alcohol engine built by Koerting Brothers, of Hanover, which supplied the power for an electric light plant, and also in the Hegner arc lamp, of the Volta Company, an invention of Engineer Hegner, which supplied the illumination of the institute. In the latter invention one-third of the electric power is saved as compared with arc lamps now in use. The Emperor posted himself thoroughly on the various electrical installations by Siemens & Halske, the Allgemeine Elektrizitaets Gesellschaft and the Union, which are now in use or are soon to be installed on board the war vessels. These were set up in the machine room, and were shown in action. The new electrical laboratory is probably the largest of its kind in the world. It contains 18 complete machines, and is supplied with electric current by a central station of 300 horse-power capacity. Power is derived from 100-horse-power gas engines, built by Koerting Brothers, in connection with a battery of accumulators from the Akkumulatoren Actien Gesellschaft in Hagen.

The Emperor and party remained about an hour in the beautiful, airy rooms, and repeatedly expressed their appreciation of the many advantages which the laboratory offers to students in this branch of science.

There were present the Minister of Public Instruction, the Referee for the Technical High School, Privy Councillor Wehrenpfennig, the rector, Prof. Dr. Witt and most of the gentlemen of the imperial headquarters.

Mr. S. Bergmann, the well known electrical manufacturer, sailed for Berlin last week, and will remain abroad for three months looking after his large electrical manufacturing interests at the German capital.

Mr. Clinton L. Rossiter.

The ELECTRICAL REVIEW takes pleasure in presenting herewith a new portrait of Mr. Clinton L. Rossiter, president of the Brooklyn Heights Railroad Company, of Brooklyn, N. Y., who has been so active in the matter of getting the trolley cars across the bridge, the various lines virtually co-operating in the movement under his able generalship. In a recent conversation he had this to say of his road: "We have contracted for 130 new large cars for this season's business, and have put through our shop some 500 old cars to change the color to the new standard, red and yellow, and make minor improvements that will be very noticeable to the patrons. Contract has also been made for over 45 miles of new rail, and it is expected that before September 1 every line on the company's system will not only be in first-class condition, but up to a higher standard as regards equipment, motors and power than at any time since the road adopted electricity. One of the new large 2,000-horse-power engines started up last Sunday, and a duplicate is being installed. These engines will not only give abundant motive power, but greatly improve the lights at night, which in some cases have not been strong enough for reading." We are indebted to *Brooklyn Life* for the use of the excellent half-tone portrait of Mr. Rossiter.

MR. CLINTON L. ROSSITER, PRESIDENT BROOKLYN HEIGHTS RAILROAD COMPANY, BROOKLYN, N. Y.

SPEED GOVERNMENT IN WATER-POWER PLANTS.

READ BEFORE THE FRANKLIN INSTITUTE, PHILADELPHIA, DECEMBER 14, 1897, BY MARK A. REPLOGLE.

(*Concluded from page 229.*)

It is also noticed that there is in this pipe before closing the gates 338 horse-power of kinetic energy for one second. Some disposition must be made of this energy, as it is necessary that the column of water be at rest when the wheel gates are closed. The only available disposition of it is to allow it to join the power set free when the load is dropped off, increasing its effects a like amount until the wheel gates can be safely closed.

It can now readily be seen that it is not only necessary to provide power storage capacity enough in a power unit for the changes of load, but also an additional capacity for that contained in the pipes or flumes. This extra power must be provided on opening the gates before the wheel will furnish new power and must be disposed of before the wheel will stop furnishing power when the gates are being closed. In other words, if the power unit in question is 900 horse-power, and calculations were being made to provide power storage so as to allow a full change of load to be made, keeping the speed inside of a given per cent, the calculations must be based on 900 horse-power plus 338 horse-power or 1,238 horse-power change at the whole gates. This makes it clear that closed pipes should be avoided as much as possible, if the government is to be done by changing the flow of the water. If it is desired to govern by deflecting the stream in some manner, the only detrimental effect of the long pipe is the power lost or gained by the varying friction in changes of load.

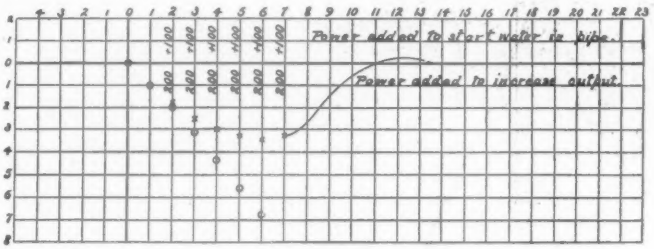

FIG. 4.—"SPEED GOVERNMENT IN WATER-POWER PLANTS."

Plate 4 is intended to show the conditions of speed on a 2,100-horse-power plant when 1,000 horse-power of load is instantly added. The kinetic energy in the pipe at full load is 1,000 horse-power for one second. The power storage of the plant is 50,000 horse-power for one second. Assuming that the speed of plant is at normal or zero line until it reaches vertical time line marked zero, where 1,000 horse-power of load is instantly thrown on. This being two per cent of the power storage, would cause a drop in speed of about one per cent during the first second after the change. If no power were added, the speed would drop a trifle more than one per cent during the second second, and continue to drop at an increasing ratio as the velocity of the revolving parts decreased. The curve indicated by the ciphers will show how the speed will drop during the following seconds if no new power were added to the wheel. Since it will require seven seconds to move the gates, the ratio of additional power supply will be 300 horse-power per second, with a maximum action of the governor. Since the increase in load is 1,000 horse-power, and 500 horse-power additional of kinetic energy must appear in the pipe, it will take the governor five seconds to add power enough to stop the speed dropping. Also, since the kinetic energy must be added to the flume in the same ratio that the new power is available, it is plain that only two-thirds of the 300 horse-power added each second is available as additional power while the velocity of water in the pipe is being increased. Hence only 200 horse-power is added as increased output for each of the following five seconds. This curve is indicated by the crosses at the ends of the several seconds. It can be readily understood that fully one second will lapse before any power-supply can effect the speed of plant. It can also readily be seen that the power storage must carry the 1,000 horse-power new load for first second. While 200 horse-power has been added during the second second, it has performed an average of 100-horse-power work during this time. The power storage then has carried 900 horse-power of the new load during the second second. Since the full 200 horse-power is being added each second, the power storage is being gradually relieved of its drain and the speed stops dropping accordingly. A calculation at the end of each second shows exactly where the speed is at such time. Space will not admit the figures here, but the curve outlined by the crosses is approximately correct.

It is now evident that a formula can be deduced that can be relied upon in the government of water-powers. It will be somewhat complex on account of the many factors that must necessarily enter into it. Many of these factors will necessarily be fixed by the conditions that attend the plant construction. The size of the power unit will always be decided upon first. Next will be the maximum change in load, with the greatest variation in speed permissible. The time of change in power-supply is dependent upon the action of gravity and the safety of the plant. When the time required to supply power for the change of load has been learned, it is an easy matter to calculate the amount of stored energy or power storage that must exist in the plant in order to keep the variation of speed within the required limits. It will not be necessary to explain the fact that the speed will vary a fraction less in dropping off a load than it will in adding it.

In reducing the formula to its simplest form it will be necessary to combine or add together quantities that are of the same denominations, as follows: The time necessary to add power to overcome the increased friction in penstock, plus the time necessary to add power to overcome the inertia of the increased flow, plus the time necessary to add power for the new load, may be represented by T. The power necessary to equalize the increased friction, plus the power necessary to overcome the inertia in giving increased velocity to the supply, plus the power necessary to carry the increased load at speed, may be represented by L. The variation allowable in speed in terms that are a fractional part of normal speed may be represented by F, and the power storage may be represented by S. Since the power storage must carry the new load for one-half of T, and since the speed of plant varies in one-half of the ratio that the stored energy is given out or absorbed, it is evident that the formula must read:

$$\frac{\frac{T\ L}{2}}{2\ F} = S.$$

Further reduction makes it read:

$$\frac{T\ L}{4\ F} = S.$$

The following example will make its use understood:

$$\text{In the formula } \frac{T\ L}{4\ F} = S,$$

Let T = 4 seconds,
L = 1,500 horse-power,
F = 3 per cent or $\frac{3}{100}$ variation in speed.
By substitution we have

$$\frac{4}{4} \times \frac{1,500}{\frac{3}{100}} = \frac{6,000}{\frac{3}{100}}$$

= 50,000 horse-power = S.

In the formula let T represent four seconds, L 1,500 horse-power and F three per cent, or $\frac{3}{100}$ variation of speed allowable. In making substitution and reducing, the stored energy or power storage in the power unit must be 50,000 horse-power. This is the amount necessary if 1,500 horse-power is to be added, and it requires four seconds to get the proper effect from the power supply, providing the variation in speed must not be over three per cent from normal.

Before closing it will be necessary to make a few suggestions concerning governors. A properly constructed governor must open the water-wheel gates as fast as gravity can follow up with water, no faster. It must close the gates slow enough to insure safety to the penstocks, no faster. It must be capable of stopping the gates at any degree of opening. It must be endowed with the relay principle, adjusted to co-operate properly with the power storage. It must not be a separate and independent feature of the power plant, but must be made a part of the plant in an intelligent manner, and at best it is only one of the factors in the government of a water-power plant. It must be remembered that all the governor can do is to open or close the gates as the variations in speed require, and no water-wheel can be governed successfully by varying the gate openings, unless the same principles are adhered to that make government in steam engines a success.

The relay principle allows the governed motor to run at a slower speed when loaded than when running empty. This is for the purpose of using systematically the stored energy of the revolving parts of the power unit. Recently a new feature, generally known as the returning principle, has been added to some of the best known governors. Both the relay and returning features will be shown in Plate 5.

It is well understood that water-wheel gates are too ponderous to be moved directly by the centrifugal effect of governor pendulums. It is necessary to allow the speed governor to trip some heavier mechanical apparatus which moves the heavy gates. In some governors the pendulums throw into action an auxiliary power that in turn trips the apparatus that moves the gates. In Fig. 1, A is a speedy governor, B its pulley that receives motive power from the water-wheel shaft, *c* is a trip to cause the heavy apparatus to close the gate, *d* is a trip to cause the mechanism to open the gate, *w* is the wheel, *g* is the wheel-gate and *l* is a connection between gate and speed governor. (For the sake of convenience in the illustration *l* is a straight lever.) When the lever is so held by the governor balls that it touches neither *c* nor *d*, the gates do not move. If a change in load causes the speed to drop, the governor balls will allow *l* to touch *d*, and immediately cause the power mechanism to begin to open the gate. The gate in opening will raise *l* off of *d*, as is shown in dotted lines, causing the gate-moving apparatus to drop out of action. If this operation did not add new power enough to prevent the speed from a further drop, the same operation is repeated until the new power balances the demand and *l* touches neither *c* nor *d*. It will be noticed that the governor balls are running at a lower position after the gate has been moved to a wider opening. In practice this is a fact, and in this lowering of the speed a portion of the stored energy of the plant is fed out and used in carrying the new load, until the effects from the increased gate opening can be had.

If the power storage of the plant is proportioned properly to the change made in load, the speed can never fall out of the relay limits of the governor. But if the power storage is deficient, the speed, on making a heavy change in load, will quickly drop out of the relay limits, and the governor will then be at sea. The effect is called hunting or racing by engineers. Let it be understood that an increase in speed will cause *l* to touch *c*, and close the gates in a similar manner.

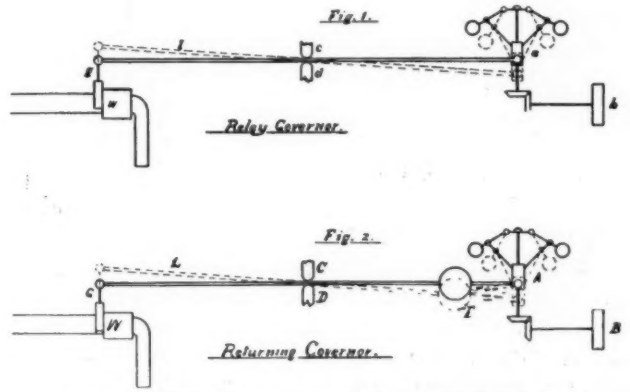

FIG. 5.—"SPEED GOVERNMENT IN WATER-POWER PLANTS."

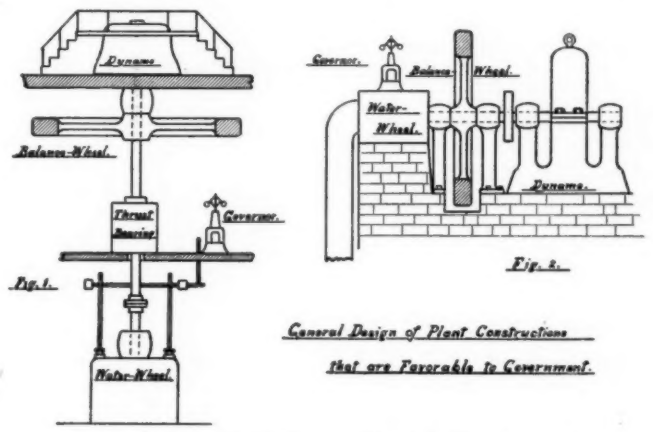

FIG. 6.—"SPEED GOVERNMENT IN WATER POWER PLANTS."

Fig. 2 is similar to Fig. 1, with the exception that L is flexible or jointed at E. In a change of load L operates as a stiff lever, but after the equilibrium has been temporarily restored the lever L slowly begins to bend at E, allowing A to return to its original position. This bending or returning will cause L to touch D and add a little more water, until A has found its original position or speed, as is shown by dotted lines. It will be noticed that the power storage in Fig. 2 is made use of in adding new load, by lowering the speed in the same manner as in Fig. 1. But this defect is corrected later by the returning principle. The effect of the returning principle is to return the speed always to normal, leaving it identical with the speed at no load, a condition not ordinarily found in speed government where the relay governor is used.

Let it be understood that all steam engines that are successfully governed are controlled by the use of a relay governor, although it is not apparent to the casual observer. Some of our best steam engines use the returning principle in connection with their governing, although no reference is made to it in ordinary conversation concerning steam-engine government.

The science of water power government has not yet reached so great a degree of perfection as the government of steam power, yet the underlying principles are being carefully studied by our engineers, and the time is not far distant when our water-powers will all be constructed and governed as reliably and successfully as our steam plants are, but that time will not come until the same principles are recognized in the former as in the latter. (Plate 6.)

The Hawaiian Cable.

Senator Brown has introduced in the Hawaiian Legislature a bill authorizing the construction by the Pacific Cable Company of a cable between the United States and Honolulu. The Pacific Cable Company, better known as the Scrymser Company, is the concern which has just obtained a favorable report from a congressional committee at Washington on bill to enable it to lay the cable. The Hawaiian bill gives the company exclusive cable rights here for 20 years. The cable must be laid within 18 months after the passage of the act by the American Congress and extended to Japan within three years. It must be capable of transmitting 15 words a minute.

Electrical Review

[OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.]
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CHANGES for advertisements must be in this office by Friday noon for the following week's issue.
NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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Mr. Edison is credited with a plan to detect torpedo craft by scattering floating cans of calcium carbide and phosphide beyond the effective radius of these boats, thus silhouetting any boat within such radius. Why not leave out the igniting phosphide, and kill the enemy by suffocation in the vile odor of acetylene gas? Give it to them hot and fresh, and the fresher the viler, strange to say. A few tons of hydrogen sulphide, too, might make them wish for their home firesides and the dearly beloved garlic.

The importance of electricity in the recent war preparations can not be estimated now—the future will contain a brilliant record of its services.

An article in last week's ELECTRICAL REVIEW, describing how a government torpedo cable in course of manufacture in New York city was damaged by a supposed Spanish sympathizer or spy, created a great deal of interest, not only among electrical manufacturers, for whom the story was printed as a warning, but also among the daily press. The editors of the ELECTRICAL REVIEW were interviewed by enterprising reporters, who endeavored to discover the name of the manufacturing firm involved. This information was consistently refused, but one zealous newspaper man discovered the firm and printed a commendable story reciting the facts. Now that the matter has become public, it is needless to remark that electrical manufacturers will be more than ever on their guard against the recurrence of such dastardly attempts.

If war comes and our costly ships get into active engagement, we think many of the operative parts of the present equipment moved by steam or hydraulic motors will be found inadequate to the emergency service of battle. And we predict thereafter a revolutionary change to electric motors for all such devices. Imagine the turret of a battleship becoming useless just when its guns are being trained on another warship within sinking distance, all owing to a leaky pipe joint, or a sticking valve, or defective packing, or any one of a hundred possible defects, trivial enough, but fraught with terrible consequences in such a case. No pipe system, whether steam or hydraulic, ever was or ever can be as reliable as a well laid electric conductor, and no hydraulic or steam motor ever was or ever will be as prompt to start, as effective and easy to control, or as reliable in every way, as a modern electric motor; and the sooner our naval constructors realize this the better will be their product.

ELECTRICAL INSPECTION IN NEW YORK CITY.

For many years the electrical contractor doing business in New York city has considered his lot an especially hard one, owing to the several inspections his work was obliged to pass and the diverse rules under which these inspections were made. Previous to January 1 of the current year every electric light and power plant installed in a building in New York had to pass primarily an inspection of the municipal Fire Department. The rules of this department were based on what was believed to be modern electrical practice, on the local ordinances and laws, and on the state laws affecting municipalities. If it was not desired to insure the building harboring the plant under inspection, the matter was settled at this point. If, however, insurance was desired, a second inspection by the insurance authorities was required before a policy would be issued on the risk. It very often came about that the rules laid down by these two authorities conflicted, usually to the detriment of the contractor.

When the Greater New York Charter went into effect on January 1, 1898, the functions previously incumbent upon the Board of Electrical Control and the Electrical Inspection Bureau of the New York Fire Department were transferred by law to a newly created authority, legally known as the Department of Public Buildings, Lighting and Supplies. This department was placed in charge of a commissioner, Col. H. S. Kearny, who had been formerly chief engineer of the Board of Electrical Control, and up to January 1 a member of the Board of Electrical Control.

One of the first tasks undertaken by the new Department of Public Buildings, Lighting and Supplies under the direction of Colonel Kearny, was the preparation of a set of rules for the installation of electrical appliances for light, power and heat. The ELECTRICAL REVIEW has just received an advance copy of these rules, which, we are pleased to observe, are adapted from the National Electrical Code of 1897, with amendments to meet the requirements of the department from which they emanate. We understand that advance copies of these proposed rules have also been sent to other authorities in the electrical field, with a request that they be criticized in the light of modern practice. The ELECTRICAL REVIEW is assured that due consideration will be given to these desired criticisms when they are received.

In the meantime, we believe that some confusion exists among electrical supply manufacturers and contractors in regard to the inspection requirements now obtaining or soon to be enforced in New York. The general idea seems to be that instead of two inspections in a case where a building is to be insured, one by the Fire Department and one by the insurance authorities, as in the past, there will hereafter be required three inspections. As intimated above, this is not the case, for the reason that the Fire Department inspection has been transferred to the Department of Public Buildings, Lighting and Supplies. Furthermore, the new rules proposed by the latter department are based on the National Electrical Code, and the principal changes that have been made are those of an explanatory character, which, we are informed, were made by men of experience, after due consideration and thought.

After a careful comparison with the National Electrical Code of the rules proposed by Colonel Kearny, both sets of rules, by the way, occupying about the same amount of space, the ELECTRICAL REVIEW is free to confess that apparently no additional burdens will be imposed upon the electrical manufacturers or contractors under the new rules. With all due respect to the National Electrical Code, it contains certain requirements, which, physically and electrically, are undesirable of enforcement in New York, but which, at the same time, are doubtless requisite in practice in smaller cities and towns where the same electrical conditions do not obtain. As we have remarked, the amendments to the National Code are chiefly of an explanatory character, and so far we have been unable to discover where these two sets of rules conflict in any important degree. From our view point an installation that will pass the proposed rules of the Department of Public Buildings, Lighting and Supplies will also pass the rules of the National Electrical Code. As this new department has been created to perform legally the special duties imposed upon it by law, and as the number of inspections for plants installed in New York has not been increased, we can not see where the electrical manufacturer or contractor is unduly or newly oppressed. In fact, if our understanding of the matter is correct, the burdens of the electrical contractor in New York have been, if anything, decreased, for the one reason, if no other, that his work, when passed under the proposed rules, will surely meet the requirements of the National Code. While at the first glance it may appear that Colonel Kearny's rules have unnecessarily enlarged upon the requirements of the National Code, we think, if the proposed rules are put in practice, it will be found that they have simplified a matter heretofore complex and annoying. We feel sure also that if any conflict of practice or experience between the two sets of rules is discovered, it will be speedily corrected with due allowance for the rights of the electrical manufacturer and contractor.

Wall Street and the Electrical Stock Market.

As the time approaches when the international complications must assume definite shape, either for peace or for war, trading in stocks and bonds becomes more and more restricted. In the security markets the professional element has continued to predominate. Speculators and investors alike are awaiting either peace or war. What they want is a certainty, and until they get it the stock market will necessarily drag slowly along.

General Electric, with the exception of Monday, when 2,600 shares were sold, was unusually quiet during the week, and the price fluctuated between 31¼ @ 32¾. The debenture 5's sold at 101. It is learned on good authority that the annual report of the company is already in type and will be obtainable within a few days. The matter of a settlement with the preferred stockholders will be set forth in full in the report. As now contemplated the plan will be presented to the stockholders at the annual meeting with a recommendation that it be ratified by them. Gratifying increases will be shown in nearly every department.

Western Union sold down from 87½ on Monday to 85¼ on Wednesday, rallying about a point at the close. The collateral 5's changed hands at 109. American Telegraph and Cable was inactive, only a small sale at 91 taking place. Edison Electric Illuminating of New York sold up from 118 to 121 on light transactions. North American recorded the usual sales of about 2,000 shares per week at 5⅜ @ 5½.

The weakness in Brooklyn Rapid Transit, which opened at 39 and sold down 2 points, was chiefly due to the report that the city was contemplating the desirability of making the company pay more for the use of the Bridge, on the ground that the city's receipts had fallen off considerably since the trolley began running over it.

The Edison Electric Illuminating Company of Boston has declared the regular quarterly dividend of 1¾ per cent, payable May 2.

The board of directors of the Sprague Electric Company, of New York city, have declared a dividend of three per cent on the preferred stock payable on May 2, to shareholders of record April 18.

The electrical stock market in Boston was more active this week than last. Bell Telephone gained 7 points to 255 on Tuesday, declined to 247 Thursday, and closed at 250. Erie Telephone was quiet, selling at 63. New England Telephone was quoted at 125 @ 125½; Westinghouse common, 20¼ @ 20½, and the preferred, 51 to 52½.

On the Philadelphia Exchange Electric Storage Battery common sold at 19 @ 20, and the preferred 22⅛ @ 22¼. RAY.

Wall Street, April 16.

LATE NEWS.

A deputy sheriff has received an attachment against the Bell Electric Company, manufacturers of electric bicycle lamps, at 46 East Fourteenth street, New York city, for $300 in favor of the Meriden Britannia Company for rent.

Crage & Tench, of Buffalo, N. Y., have secured the contract for building the Lima & Honeoye Falls Electric Railroad. The contract includes the wiring of the streets of both villages for electric lights as well as the construction of a power-house. The firm had a large force of men at work on the contract last week.

The Syndicate Construction Company has been organized at New Brunswick, N. J. Judge Gottfried Krueger, Edward H. Radel and Andrew Radel are its backers. The articles of incorporation state that the company is formed to construct and operate electric railway lines in Middlesex, Somerset, Union, Mercer and Camden counties. The company is capitalized at $50,000. The men interested are officers of the Brunswick Traction Company.

The Peekskill Traction Company has been incorporated, with a capital of $150,000, to operate a street surface electric road in and between Peekskill and the towns of Cortland and Yorktown, in Westchester County, N. Y. The road will embrace a line to the state camp. The directors are Charles Mason, James A. Haight, Frank Frye, Charles N. Wells, Jay R. Decatur, Matthew Clune, James F. Martin, Hanford Smith, of Peekskill, and Jacob Larrsch, of New York city.

The Edison Light and Power Company of La Crosse, Wis., at their annual meeting elected the following directors: F. A. Copeland, J. J. Hogan, E. E. Bentley, S. Y. Hyde, James McCord, A. Hirshheimer, G. Van Steenwyk. At the meeting of the directors, F. A. Copeland was elected president, and E. E. Bentley, secretary and treasurer.

The Electrical Exhibition.

During the Electrical Exhibition to be held at Madison Square Garden, New York city, from May 2 to May 31, arrangements have been made for the meetings of about 50 associations of the National Association of Stationary Engineers. These associations will come from New York, New Jersey, Pennsylvania, Massachusetts, Rhode Island and Connecticut. Several rooms suitable for meetings have been provided, and various lodges invited almost without exception have accepted the invitation and will hold their meetings there on their regular meeting night as the guests of the Exhibition company. It is expected that there will be an attendance of at least 5,000 practical engineers (two lodges every evening), and the exhibition management is arranging a registry system with bulletin boards in different sections of the building, so that exhibitors may know just what associations of engineers are present and the plants with which they are connected.

In connection with the telegraph tournament to be held during the exhibition, an executive committee has been appointed to take care of all matters embraced in the duties of the judges. The executive committee consists of Fred Catlin, A. E. Sink, T. J. Smith, P. B. Delany and J. B. Taltavall. Mr. T. J. Smith has been appointed a committee to arrange for suitable phonographic records, and Mr. P. B. Delany to provide apparatus for chemical or other records not phonographic. Friday evening, May 13, and Saturday afternoon and evening, May 14, are the dates on which the tournament will take place.

The executive office of the Electrical Exhibition Company is now located at the Madison Square Garden, where communications for Mr. Marcus Nathan, general manager, should be addressed.

The Magnetic Club.

The Magnetic Club of this city celebrated its decennial night at the St. Denis Hotel, April 13 last. Mr. R. J. Hutchinson, the president, presided, and about 150 gentlemen were present. Among the past presidents in attendance were Messrs. Charles P. Bruch, William J. Dealy, Edward C. Cockey, William H. Baker and Edward H. Johnson. The occasion was a very enjoyable one. A unique and particularly attractive menu was printed in colors for the occasion by Mr. James Kempster, and contained pictures of the five presidents named.

PERSONAL.

Mr. H. E. Robinson, secretary of the Peninsular Electric Light and Power Company, Orlando, Fla., is visiting New York city and arranging for the purchase of new apparatus for his company.

Mr. Edward R. Knowles, the well known electrical engineer, has become identified with the Sprague Electric Company, where he will have entire charge of their power motor department. Mr. Knowles was recently consulting engineer for the Brooklyn Bridge company. His engagement furnishes additional evidence that the Sprague company is determined to have the best men in the right place, and both the Sprague company and Mr. Knowles are to be congratulated on this alliance.

Mr. Samuel Insull, president of the National Electric Light Association and of the Association of Edison Illuminating Companies, was in New York last week. He takes a very lively interest in the progress of the electrical exhibition to be held here next May, and has informed the management that he will, in behalf of those two representative bodies, participate in the opening exercises on May 2. These exercises, as now arranged, promise to be of an unusually striking and interesting character.

Mr. Nicholas S. Hill, Jr., mechanical engineer, of Baltimore, formerly engineer to the Electrical Subway Commission of that city, and Mr. B. C. Howard, formerly of the McCay-Howard Engineering Company, have associated themselves as Hill & Howard, 35 Manufacturers' Record Building, Baltimore, to carry on a general consulting engineering business. Mr. Hill is a graduate of Stevens Institute of Technology, and has held many important engineering positions, having recently resigned as chief engineer of the Baltimore Water Department. Mr. McCay is a graduate of the electrical department of Johns Hopkins University.

Mr. Chas. A. Boyd, superintendent of the Walker Company, of Cleveland, has resigned his position, taking effect April 12. He will enter business for himself, doing general engineering, with offices in the American Trust Building, Cleveland, Ohio. Mr. Boyd has been with the Walker Company for the past four years, starting as engineer in the railway motor department, having charge of the design and construction. About one year later he was placed in charge of the entire engineering department, and was promoted to the position of assistant superintendent on January 1, 1897. The following March he was appointed superintendent of the Cleveland works, having in charge both the engineering department and shops.

TOLD IN THE DYNAMO-ROOM—IX.

(Concluded from page 228.)

Jim studied awhile, until he apparently had grasped the subject, when he asked:

"But see here, Ned, what about the regulator on each dynamo. It seems to me each would be trying to run the circuit."

"Oh, of course, it is necessary to cut out one regulator and allow one machine to regulate for both. The other regulator must, of course, be blocked at a point to take its share of the load. This is the rule that most dynamo men seem to have adopted, and it works pretty well."

"Yes, that seems to be a very good plan as near as I can figure out," replied Jim, who proved to be a very much interested listener. "But I thought you said you had a scheme better than any of them."

"Well, you know, Jim, every doctor has his pet remedy, and, naturally, I think another plan of mine is the better," spoke Ned, thoughtfully working the regulator on one of the machines. "I adjust the regulator on the machine that is *not* to do the regulating to work at from one-half to three-quarters ampere higher, then block up to prevent the machine from taking more than its share of the load. The advantage of this is, that in case of a considerable portion of the load going off, or a dead 'short' by two grounds, both machines would be able to save themselves, where otherwise you might lose one armature, unless you happened to be near the machine. This plan is good on any two machines in series."

"Well, that is certainly an advantage," remarked Jim. "Did you 'invent' this plan yourself, Ned?"

"No, not exactly. The first time I heard of it was through a friend of mine in Chicago; we used to call him 'Ignoramus,' because he always professed to know so little. Hello, here is Benson coming along the walk, and the way he smiles, he has heard some new story."

As Ned was saying this, Benson entered the station and greeted the boys with a hearty "good evening." "And who do you think I received a letter from," he asked, taking off his coat and putting on a pair of overalls, more suitable for the night's work.

"Why, from the letter-carrier, of course," shouted Jim, edging toward the boiler-room door, but not in time to escape a half-burnt carbon, which the engineer threw at him.

"I'll throw a stilson at you the next time you try to be so funny," replied Benson, pulling a letter from his coat pocket. It's from Bert, our own Edison, and you can read it for Ned's benefit, while I get the engines in shape."

The letter was indeed from Bert, the former dynamo tender, and, while sent to the engineer, was intended for all. It read as follows:

CLEARWATER, MARCH 29, 1898.

MY DEAR BENSON AND FELLOW ELECTRICIANS — According to my promise, I take my pen in hand to write you that it is no easy job to be an electrician for a concern where the boss don't know the difference between a dynamo and motor. But his father is a banker, and he thinks his boy, who is a graduate from some college, can build dynamos. Well, I found he got out some tolerably fair direct-current stuff, but when I came he told me that he thought we ought to build some transformers as there was money in them and he wanted to carry out some ideas of his own. Well, one of those ideas was that the reason other transformers are not efficient, is because the iron core is not subdivided enough. So he had me wind a set of coils, and then he had one of the men cut up a lot of soft Norway iron wire, about No. 10 gauge, into little pieces about one-fourth-inch long, until there was about a bushel of them. They looked like a bushel of black peas. Then he made me put a layer about two inches deep into a square wooden box, lay on the coils and then fill the box level with the chips. We screwed on the cover and connected some 30 lamps to the secondary, hitching the primary to the city circuit, which runs into the factory for testing purposes. The boss closed the switch, and then you think up went the fuse, but it didn't. The lights came up just beautifully, but that box made more noise than a box of monkeys. We could hear how the water-wheel at the station would vary in speed by listening to the vibrations.

"Well Bert," said the boss, "now we'll go to supper, and afterwards come back and make some temperature and efficiency tests. I think we have the transformer."

Well, so do I. We left the lamps burning and went over town to supper. On the way the boss told me that he would fix the humming all right by pouring a lot of plaster paris over the chips.

We came back in about an hour, and as we neared the factory we could see the lights shining brightly.

"There you are, Bert," said the boss, "it's a success, sure."

We walked upstairs to the testing-room, and as we passed in the night watchman said:

"I'm glad you got back, Mr. Crocker, because that wooden box is getting all-fired hot; it's almost smoking."

We rushed into the testing-room, and as we came near the bench we could see the smoke coming out of the cracks and the smell of burnt shellac made me think of the time our last exciter armature went up in smoke. We unscrewed the lid of the box, having switched off the current, and when we dug out the coils, we found the greatest mess of charred insulation and red-hot wires you ever saw. We are going to make some transformers out of sheet iron now, like the other fellows. Well, barring the smartness of the boss, I can't complain of my new job. Hope you and Jim are running things in good shape. Suppose you have some good man in my place, judging from reports. Give my regards to the boss and ask Dettmer if his wife is completely cured. Tell Jim I'll expect an invitation soon.

Yours electrically,

BERT FORD.

"Well, boys, I think Bert will be gray-headed before long, if he has to do much inventing," remarked Ned, who had carefully listened to Jim's reading. "There are a great many peculiar things in this alternating-current business, and when I have a chance I'll tell you some of my experiences. Now I think we better get these lights going, and when you write to your friend Bert send him my best regards."

Searchlights for the Government.

It is said that orders for 10 electric searchlights for equipping government men-of-war have been already placed, but that many more times this number will be ordered by the government officials within a short time. This first order, it is understood, has been placed with the General Electric Company, and the work is now being rushed at their Schenectady shops. The Rushmore Dynamo Works, of Jersey City, say they have recently increased their mechanical equipment with the expectation of receiving a favorable response from the government in answer to their bid for filling at least a portion of the order yet to be placed.

The Westinghouse Electric and Manufacturing Company is about to install a complete electric lighting plant in Columbus, Pa. It will be used for furnishing a portion of the municipal lighting.

Indicating Different Wires by Colors.

TO THE EDITOR OF ELECTRICAL REVIEW:

I have read your short leading article in issue of April 13 on distinguishing wires and pipes by marking them with different colors.

I do not undertake to pronounce upon the question which you think would be of interest; viz., "whether the steam engineer borrowed the idea from the electrical engineer or vice versa;" but I can tell you and your readers that, as far as the wires are concerned, the idea goes back into the dark ages. The British patent for Cooke and Wheatstone's telegraph system bears date June 12, 1837, and is numbered 7390; the United States patent for the same system is No. 1622 of June 10, 1840; and we find in both a proposition for the use of compound conductor cables.

Both, referring to these cables, say: "In order to be able at all times to identify the several conducting wires, it will be expedient to use varnish of different colors in preparing them; wherefore one color will always distinguish the wire 21, another color the wire 22, and so on of the others."

Probably the question suggested by your article would have to be answered "Naythe;" when we take into consideration the custom which has existed from time immemorial (if we take the evidence of Holy Writ) of differentiating twins by marking them with diversely colored cords or ribbons. Faithfully yours,

THOMAS D. LOCKWOOD.

Boston, April 14.

ELECTRIC RAILWAY NOTES.

The statement for the month of March, 1898, of the Columbus, Ohio, Street Railway Company is as follows:

	1898.	1897.
Gross receipts	$52,279 09	$48,042 88
Operating expenses	24,498 14	22,794 61
Net	27,780 95	25,248 27
Fixed charges	16,803 79	16,427 24
Net profits	10,977 16	8,821 03

Operating expenses, 1898, 474 per cent; 1897, 478 per cent.

Increase of earnings, 85 per cent.

William B. Given, of Columbia, Pa., representing Philadelphia capitalists, has purchased over $500,000 worth of the $666,000 issue of bonds of the Pennsylvania Traction Company, and over two-thirds of the bonds of the Columbia & Ironville and Columbia & Donegal trolleys. He is now negotiating for Lancaster and Columbia bonds. As soon as possible the Pennsylvania Traction Company will be taken out of the receiver's hands.

CENTRAL POWER PLANT ON BOARD SHIP VERSUS DISTRIBUTION OF POWER.*

READ BEFORE THE AMERICAN SOCIETY OF NAVAL ENGINEERS BY PROF. WM. S. ALDRICH.

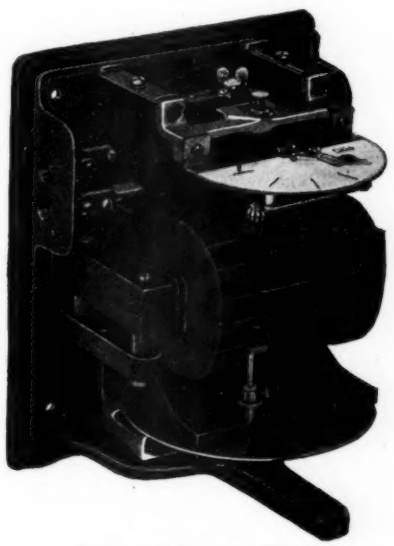
(Concluded from page 236.)

Boiler feed-pumps can now be far more economically driven by electric motors than by any of the present types of steam engine cylinders usually attached to the same. They may be set at any time for various rates of feed, and with certainty, from a switch in the boiler-room. Air-pumps and condensers may be similarly operated, and have their speed and vacuum controlled by simple switch in engine-room. All low-lift suction-pumps, bilge-pumps, etc., may be very efficiently operated by either geared or direct-connected slow-speed electric motors. In fact, the whole of such electric lighting and power plant installation on board ship may be operated at all times at the most economical and nearly uniform loads, and at uniform steam pressures and speeds for the dynamo engines. This can not be said of the steam engines operating any other kind of auxiliary machinery or operating any other system of power distribution. The inherent advantages of the electric system are chiefly due to the facility of transformation of electrical energy, especially in view of the fact that all such transformations (with or without load variations) in no special manner affect the efficiency and economy of the steam engines driving the electrical generators.

Concerning the effect of variations of load in modern electric power-plant engines, it is interesting to note that Messrs. A. G. Pierce and R. S. Hale state of the Boston Edison stations: "As a matter of fact, the steam per indicated horse-power in our two 200 units holds within 12 per cent over a range from one-quarter up to full output."*

While the above has been noted in the case of large engine-dynamo units, it is none the less true that remarkably uniform rates of steam consumption may be obtained in smaller compound direct-connected units, as has recently been noted in the "Journal" of our society.† Two questions are primarily involved in a general consideration of this problem—economy of installation and efficiency of operation. Respecting the first, it is possible to obtain refinements of design and economic arrangements of installation not yet reached in electric power plant by adopting heat-unit specifications and subsequent contract trials upon this basis. At least, the efficiencies, economies, guarantees and contracts now being realized in modern high-duty pumping plants should be much more nearly approached in electric power plants. The special features of such heat-unit ratings have been presented by the author in two recent papers before the American Society of Mechanical Engineers,‡ from which, as an example of such ratings, the table on the next page has been taken, being compiled from the report of the Committee on Data of the National Electric Light Association, Buffalo meeting, June 8, 1897.

There are certain inherent considerations in the use of any working fluid, as well as practical details for its distribution, which set the limits for each of the respective systems. Steam, electricity and compressed air will stand up to the work and permit a considerable overloading of generators and motors. The hydraulic system, on the other hand, is limited and must be installed throughout large enough for the maximum capacity ever likely to be required of it. Again, it is clearly of little avail to transmit power by water or compressed air, and have to transform it again into any particular mechanical movement or any required source of energy whenever and wherever such may be required on board ship. Light, heat, ventilation, power for rotary and reciprocating movements, water for sanitation and fire service, and refrigeration, are all required to be amply provided for, and such services efficiently maintained, on board every naval vessel. The merchantmen have led the way in some instances in the application of electrical distribution, for several of the requirements above noted may serve to indicate the possibilities in store for similar central electric light and power plants to be located on naval vessels. Electricity will, directly or indirectly, provide for all of the above services on shipboard, and in an economical manner, with the exception of distributing heat. This, of course, will remain to be supplied by steam distribution or the forced circulation and ventilation of the hot-air system. For quickness and certainty of action, as well as almost instantaneous application of the motive power applied, electricity scarcely has a competitor, especially when the power is to be applied in an accumulative manner. An instance of this is the recent contract for the operation of the turrets of the battle-ships "Alabama" and "Illinois" by electric motors, following in the wake of the cruiser "Brooklyn," similarly fitted out with electric gear.



A STORAGE BATTERY METER.

A Storage Battery Meter.

The increasing application of storage batteries, consequent on their perfection to electric light and railway station use, as well as to street cars, motor carriages, electric launches, etc., where a portable source of power is requisite, has led the General Electric Company to develop a special type of meter which will show at a glance the amount of energy available in the battery. The Thomson recording storage battery meter resembles, in general appearance, the standard Thomson recording wattmeter, and is, in fact, a development from it, the mechanism being almost exactly similar. The accuracy and durability characteristic of the standard type have both been maintained, while additional precaution is provided against injury from shock or vibration. The meter is provided with a single indicating needle moving over a horizontal semicircular dial.

The essential requirement for a storage battery meter is that the armature shall rotate in either direction and give equally accurate readings in both. In this meter this requisite is fully preserved. The energy put into the cells is, therefore, added to the reading of the meter, while the energy withdrawn is subtracted, but to compensate for the loss in the cells the meter runs more slowly when charging. The reading of the meter represents not the amount of energy put into the battery, but the amount available, and when the needle points to zero on the dial it shows that the battery is completely discharged.

For motor carriage, street car and electric launch service, a meter of this character is a most necessary adjunct. Indeed, any of these vehicles of transportation, not equipped with a device to warn the operator of the amount of current available to carry him forward on his journey or to bring him back to his starting point, would be incomplete. Without it he is absolutely ignorant of the power upon which he can depend, and would run serious risk of finding himself at a standstill far from home with no means of getting either forward or backward without recourse to some mechanical method.

The durability and efficient operation of storage cells being maintained by recharging them before they are exhausted, the only method of learning of their exact condition is by a meter of this character. The cells being recharged at the right time, the general result is a much higher battery economy.

These meters are manufactured with any desired percentage difference between charging and discharging rates, and in all of the standard sizes in which two-wire Thomson recording wattmeters are built. Since, however, this percentage varies in almost every case, the General Electric Company manufactures them only to order. One size, that reading to 50 amperes, however, may be considered as standard and will be more promptly furnished than any other.

The Babylon, N. Y., & North Shore Railroad Company has been incorporated, to operate a line of railroad by motor from Babylon to Northport, Suffolk County. Its capital is $160,000, and its directors are W. F. Norton and W. S. Nicoll, of Babylon; A. P. Dodge, C. L. Easton, W. R. Bergholz and E. A. Dodge, of New York city; J. H. Young and F. J. Oppenauer, of Brooklyn, and T. J. Moin, of Arlington, N. J.

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*Quoted by Mr. F. R. Low, Report of Committee on Data, National Electric Light Association, Buffalo meeting, June 8, 1897.

†*Journal of the American Society of Naval Engineers.*—"High-speed Self-Lubricating Steam Engines," by Alfred Marcom. Vol. IX., No. 4, November, 1897.

‡"Transactions of the American Society of Mechanical Engineers," Vol. XVIII, No. 733, "On Rating Electric Power Plants on the Heat-Unit Standard;" and Vol. XIX, No. 766, "Notes on Rating Electric Power Plants on the Heat-Unit Standard" (second paper), by Wm. S. Aldrich.

THE REGULATION AND PROTECTION OF THE ELECTRIC MOTOR.

READ BEFORE THE CHICAGO ELECTRICAL ASSOCIATION, APRIL 1, 1898, BY HARRY H. CUTLER.

(*Continued from page 251.*)

Diametrically opposed to the fan regulator is the electric elevator controller. This work calls for continually starting and stopping several times a minute all day long; heavy renewable contacts are absolutely necessary, as well as a special type of motor, and problems of entirely different character are to be met with. It is not practical to build an elevator controller all ready to fasten to the wall with a string hitched to it for the operator to pull. Such devices are on the market in abundance, but should be regarded as a source of great danger.

An elevator controller to be safe should be embodied into and form a distinct part of the elevator mechanism, and should be attached to the elevator mechanism by the elevator manufacturer and not by the motor manufacturer or their selling agents.

There are a great many good methods of operating electrical elevators on the market. Among these methods in most common use is the system which uses a compound-wound motor and compound regulation. The motor is started through external resistance, which can consist of a rheostat or the windings of the series coils themselves. This resistance is then cut out in several steps under control of some kind of a governor; the series field coils are then cut out and finally the *shunt* field is weakened by the insertion of external resistance. The operation of electric elevators brings up the problem of how to reverse an electric motor. To accomplish this it is only necessary to change the relative direction of the current in either field or armature circuits. The moment we do this, however, new troubles arise; means must be provided to prevent the possibility of reversing the direction of the current without either first stopping the motor or at least inserting internal resistance into the armature circuit. Means must also be provided to prevent excessive sparking or burning at the switches as well as undue strain on the insulation of the motor.

In order to reverse a motor the field and armature have to be controlled by independent circuits. Whenever a circuit is suddenly opened that contains coils of wire wrapped around a mass of iron, a secondary or induced current is formed, which has a potential many times higher than that of the primary current. This current not only burns the switches, but is sure to puncture the insulation of the motor, sooner or later, unless means are taken to prevent it. Many designs of elevator controllers and rheostats on the market try to overcome sparking by opening the circuit with a snap switch, but electricity can not be fooled in any such a simple mechanical manner as this. The flash and consequent strain on the insulation of the motor is only increased the more, and all that is gained is that the switch does not burn up so quick. This is no dream, but it is an actual fact that the market is flooded with rat-trap devices which claim to eliminate sparking by means of snap switches. A snap switch is well enough for use in a lighting circuit, but when used in connection with a reversible motor it is a constant menace to the safety of its insulation. Every one knows, who has handled a motor, that if the double-pole knife switch is pulled even when the motor is heavily loaded a destructive spark is never obtained. The reason for this is that the armature and shunt fields are not separated, and consequently no induced current is formed in either and no strain whatever on the insulation occurs. The motor becomes a generator, energizing its own field and gradually slows down and loses its magnetism. A similar condition of affairs can be obtained on a reversible motor. Before opening either the field or armature circuits, both sides of the line should be opened simultaneously, which, of course, will cause no sparking, as just pointed out. External resistance should then be inserted into the armature circuit, and, finally, the armature connections should be reversed, leaving the shunt-field circuit at all times closed upon the armature. No destructive sparking or strain upon the insulation of the motor will then occur, the supply of current is absolutely cut off from the motor, and the short-circuiting of the armature, through the resistance of the rheostat, occurring while the field is at full strength, acts as a dynamic brake and assists to stop the motor. This method of braking a motor is easily worked out, so that the ordinary mechanical brake never sets until the motor has stopped, or nearly so.

Fig. 1 shows a method of reversing a motor without sparking at the switches or strain on the insulation, and at the same time entirely disconnects the motor from the line.

When an elevator is coming down with a heavy load the motor has no work to do, and consequently has a tendency to run away, being driven by the weight of the elevator. If the motor is plain shunt wound and its field kept at constant strength, the load on the elevator will tend to drive the motor so much above its normal speed that it becomes a generator, and returns current to the line. The speed of the motor will then increase until a potential is reached sufficiently above that of the lines to consume the power derived from the effective weight of the elevator. The motor will continue to revolve at this speed, which, in case of the plain shunt-wound motor, would not be a dangerous speed. But plain shunt motors are now seldom used for elevators; almost all builders of elevators use compound-wound motors, or at least shunt motors whose field is weakened after starting.

Motors which bring an elevator to full speed by weakening the field would run much faster when driven by a heavy load on the elevator, and it becomes necessary for the attendant to check the speed by moving the lever back and thus strengthening the field. Should the attendant move the lever so far back that external resistance is inserted into the armature circuit, the speed of the elevator would be increased instead of decreased, as at first might be supposed, and a dangerous speed would result. This curious condition of affairs is due to the fact that, with external resistance in the circuit with the armature, when the motor is running as a generator it will have to run enough faster to produce sufficient potential at the brushes to overcome the external resistance and deliver to the line the increased potential necessary to check the speed of the motor.

The application of the electric motor to the printing press is another problem full of interesting points, which time will not permit of taking up, and we will pass on to the second part of the subject.

THE PROTECTION OF A MOTOR.

Motors burn out when overloaded, because they get hot. They frequently burn out also because currents of high potential are allowed to occur which puncture their insulation. Excessive currents scar the commutators and foreign material produce circuits which lead to damage.

To properly protect a motor from damage by the electric current, these four effects must certainly be guarded against.

Motors can only become dangerously hot by abnormal currents being allowed to flow for an appreciable length of time. A current of double or treble that of the continuous safe carrying capacity of the motor will not do the slightest harm, unless allowed to flow long enough to overheat the motor. When such abnormal currents last only a few seconds it is neither necessary nor desirable for the protecting device to operate, and a properly designed protector should not operate unless the temporary abnormal currents exceed this amount, or last long enough to overheat the motor. Since it is the heating effect of the current which causes an overloaded motor to burn out, the most natural protection would be a device that operates through the influence of this same heating effect of the current. The well known fuse was, therefore, recommended for this work, and the electrical trade accepted it without question. As motors came into more general use it began slowly to dawn upon the electrical profession that they were being misled in their implicit faith in the fusible cut-outs offered by the trade. Too many motors supposed to be protected by fuses burn out, and experiments show that the ordinary commercial fuse will blow at almost any amount of current or not at all, just as it happens to feel at the time.

The manufacturers then attempted to more thoroughly standardize their fuses, and even made a faint attempt to standardize the cut-outs for holding them.

(*To be concluded.*)

Improved Crank Shafts.

An important and interesting patent on a "combined shaft and disk" (patent No. 601,965, April 5, 1898) has just been issued to A. L. Ide & Sons, the well known engine builders of Springfield, Ill. The patent refers to the construction of the crank shafts now used in the Ideal engines, consisting of shaft and disk of one piece of gun metal, or one integral casting, with steel core or strengthening rod cast in the center of the shaft and made part thereof. This construction has been used by the firm named for several years past, and owing to the great strength of this patented construction, out of several thousand engines equipped with these shafts, not one has been reported as notwithstanding the greatest strain of the most exacting service. It is said that the gun metal has been found to make a more serviceable, better wearing and more perfect bearing than where the shaft comes in contact with the metal.

American Tool Works Company.

With the election of the officers of the American Tool Works Company, of Cincinnati, successors to the Davis & Egan Machine Tool Company, the latter concern passes out of existence and is succeeded by the former in all connections. The directors were elected last week, and the board organized by making Charles Davis president; B. B. Quillan, vice-president; Henry Luers, secretary and treasurer, and these, with Robert Laidlaw and Thomas P. Egan, constitute the board of directors. The American Tool Works Company is now the active corporation, with a capital of $1,000,000. President Davis says that the machine-tool business was never better, and that an encouraging feature of it is that the domestic trade is much better, and orders for shipment in this country have greatly increased during the past two or three months.

The Thomson-Houston Electric Company, incorporated under the laws of Connecticut, and with a plant in Lynn, Mass., has filed its annual statement with the commissioner of corporations, showing a capital stock of $10,000,000, with a balance on the right side of $9,802,267.

TELEPHONE NEWS AND COMMENT.

The Standard Telephone Company has been incorporated at Newtown, Pa., with a capital of $10,000.

Harrisonville Telephone Company, Waterloo, Ill., certified to an increase in capital stock from $8,000 to $20,000.

There was a recent gathering of New York State telephone general managers in New York city, discussing the question of rates for express companies.

The independent telephone manufacturing companies are reported to be very busy supplying apparatus to new exchanges and for the extension of those already established.

The Maryland Telephone Manufacturing Company has been incorporated at Baltimore, Md. The company will engage in the manufacture of improved telephone apparatus.

The Atlantic Coast, N. J., Telephone Company has been incorporated, with a capital of $100,000; corporators, Edwin L. Reinhold, of Marietta, Pa., and Lewis Kuehnle and James B. Reiley, of Atlantic City.

The "busy" telephone answer from "Central" is being rapidly eliminated by the putting in of additional telephone lines. Subscribers, particularly in the larger cities, are realizing the advantage of providing for the increase of business calls.

Mr. Geo. Holmes has accepted the managership of the telephone exchange at Canton, Ohio. This is a very busy little exchange, and during the exciting presidential campaign of 1896 did an immense toll-line business, as it is the home of President McKinley.

The argument of general manager U. N. Bethell, of the New York Telephone Company, before the Finance Committee of the Senate of the state, has been issued in pamphlet form, and is a masterly presentation of the telephone side of the question of legislation. It was in opposition to a bill regulating telephone rates—and the bill promptly died.

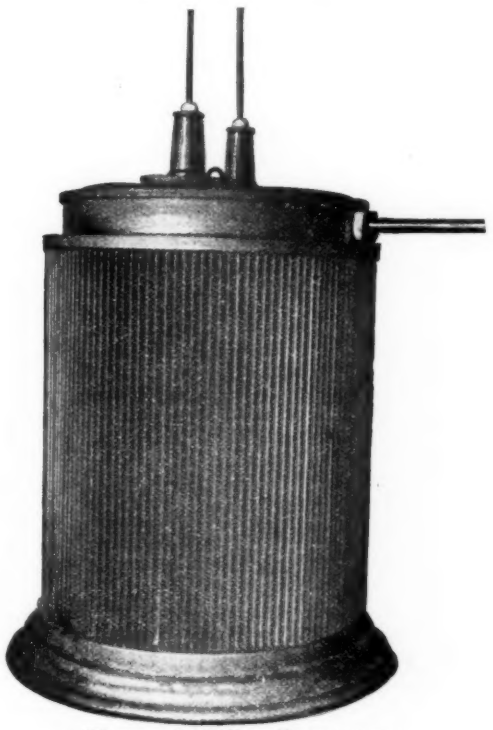
American Chemical Society.

At the meeting on April 15 of the New York section of the American Chemical Society, Thomas M. Chatard read a paper entitled "The Aurex Sluice, a New Apparatus and Process for the Electrolytic Extraction of Gold from Ores."

A New Volt-Ammeter for Experimental Work.

A unique instrument has recently been perfected by the L. E. Knott Apparatus Company, of Boston, Mass., in the way of an economical volt-ammeter. It is designed to supply the place of the standard high-priced meters for use in physical laboratories and private experimental work, where the use of the latter instruments is not absolutely essential. The instrument is to be sold for five dollars and those who are familiar with this form of apparatus will see the possibilities of such a volt-ammeter, as it has been the design of the manufacturer to make it of such accuracy and reliability that it may be safely used for all but the most serious demands. It is a direct-reading instrument, having two sets of binding posts; one set for the ampere scale and the other for the volt scale. The instruments are carefully calibrated with standard laboratory instruments from storage battery current and can be wound to any capacity. In construction, it is much like the more expensive volt-ammeters with mahogany base, aluminum casing, and with full jeweled bearings. The instruments now made range from zero to 10 volts and from zero to 10 amperes.

A New Volt-Ammeter.



Wagner 40,000-Volt Transformer.

The Wagner High-Pressure Transformer.

When, some half-dozen years ago, it was found that the development and utilization of the many water-powers in this country could only be made possible by means of high-pressure electrical transmission, dynamo builders soon realized that the pressures necessary for economical transmission were quite beyond the safe working limits of generators. The requirements of having suitable transformers, not only at the point where the current is utilized for lighting or power purposes, but also at the generating end, gradually caused an evolution of the astatic transformer. The Wagner Electric Manufacturing Company, of St. Louis, is among the foremost of the pioneers in this line.

The early installations in this work, although placed not more than half a dozen years ago, were quite "primitive," according to the standard of today. Transformers built for a local distributing service of 1,000 volts were taken and coupled up in series on their primaries until the supposedly limiting voltages of 4,000 or 5,000 were attained. The combinations were bulky and awkward in both appearance and manipulation. Very soon it was ventured to wind a single transformer to take the place of five and give at a single step an increase up to 5,000 volts. Not long thereafter the "enormous" voltage of 10,000 was introduced, and single transformers stepping up to and down from this were installed.

But even this did not fully meet the demands of many cases of long-distance transmission, so some time ago the introduction of equipments for 40,000 volts was made by the Wagner company, which will probably meet the most exacting demands for some time to come.

Such an installation, the first, by the way, to exceed 15,000 volts, has just been sent out by this company for use in Utah. An illustration of the transformers built for this installation appears herewith.

The units are 300 kilowatts each. The boiler-iron cases are circular in section, the plates being deeply corrugated to provide a very large radiating surface in comparatively small space. These transformers were so designed by reason of the specification that they be entirely self-cooling, the free circulation of the surrounding atmosphere being depended upon to dissipate the losses within the transformer. The cases are oil filled. The low-tension leads are brought out at the sides, the high-tension at the top. The general appearance is quite neat and attractive.

The development of all apparatus necessary to the long-distance transmission of power has proceeded to such an advanced stage that it is no longer necessary to allow any water-power within 100 miles of a power market to waste itself. This fact has been so clearly recognized that water-power development is taking place in every section of the civilized world with an activity that is astonishing.

ADVANCE INFORMATION

Electric Light and Power.

FORT WORTH, TEX.—E. H. Keller is putting in an electric plant for the putting of rubber tires on ordinary vehicles.

PINE BLUFF, ARK.—Wilber W. Harrison and Nat Covington have franchise for lighting, and will arrange immediately for the establishment of plant for electric lighting and for furnishing power to street railway.

HOLLY SPRINGS, MASS.—Guild & Company, of Chattanooga, Tenn., have been awarded contract for construction of $35,000 electric light plant at Holly Springs.

HUNTSVILLE, ALA.—The Huntsville Electric Light Company's plant is being erected, and will cost, when completed, about $12,000.

SHEBOYGAN FALLS, WIS.—C. S. Weissee & Company are inviting bids until May 1 for furnishing an electric plant of 20 arcs and 400 incandescent lights.

CANTON, OHIO—City Clerk may give information concerning electric light plant to be established.

PROVO, UTAH — The Telluride Power Company is about to commence work upon another plant, which, connecting with the one now in operation in Provo Cañon, will double the present generating capacity of the same.

METHUEN, MASS.—C. Dudley Holman may give information concerning the erection of an electric light plant.

POMEROY, OHIO — The Mutual Electric Light Company has secured a franchise for 25 years for furnishing this place with light.

CHICAGO, ILL.—Prismatic Light Company has been incorporated by A. G. Spalding, H. A. Christy and A. D. Eldy, to manufacture prismatic lights; capital stock, $100,000.

CISÇO, TEX. — Frank Vernon is working up interest to establish an electric light plant for this place.

TORONTO, ONT. — The Toronto Electric Light and Power Company proposes to extend its plant, and also to light the town by arc lights instead of incandescent lights.

ROCK HILL, S. C.—The Rock Hill Light and Power Company has been incorporated by A. R. Smith, David Huchison, R. T. Fewell and James W. Cherry, to establish and operate a system of waterworks and an electric light and power plant.

DANBURY, CT. — Messrs. Taylor and Starr may give information concerning construction of electric light plant.

MANSFIELD, MASS.—F. L. Cady can give information concerning construction of electric light plant.

KAUFMAN, TEX.— The electric light plant is rapidly being erected.

New Electric Railways.

ANOKA, MINN.—An electric road is to be constructed between this city and Minneapolis.

HOLLAND, MICH.—Steps are being taken to get a franchise for an electric road from Grand Rapids here.

CHATTANOOGA, TENN. — S. W. Divine and others are interested in electric railroad which is being extended to Rossville, in the suburbs.

CUMBERLAND, MD. — Peter J. Seaver and Ferdinand Williams are interested in a railroad company being formed to build an electric line in the southern part of the city.

LANSING, MICH.—The Lansing, Dexter & Ann Arbor Railway Company's directors have decided not to commence construction until the towns along the line of the proposed electric road subscribe $100,000 as a bonus.

PECOS, COLO.—The Pecos Railway Construction and Land Company, with a capital stock of $100,000, has been granted permission to do business in Colorado.

CHARLESTON, W. VA.—The Campbell Electric Traction Company has been incorporated by A. C. Gunther, D. M. Black, Richard Fiaher, E. A. Botkin and C. W. Smith, to manufacture and sell electrical and mechanical supplies for railway companies; capital stock, $100,000.

LITTLE ROCK, ARK.—The Army Post Electric Street Railway Company has been incorporated; capital stock, $85,000. The corporators are D. G. Gibson, of St. Louis, president; Andrew F. Browne, of St. Louis, vice-president; R. F. Sojourner, Little Rock, secretary and treasurer. The company will build an electric line from North Little Rock, at the foot of the free bridge, to Fort Logan H. Roots, a distance of three miles and a half.

WAUKEGAN, ILL.—A new electric railway extending from Libertyville northwesterly to the chain of lakes region is projected by Dr. E. C. Weeks, of Nashua, Iowa, who is seeking a franchise from the village board of Libertyville. He represents a company with ample capital.

CHICAGO, ILL. — The Chicago, Waukegan & North Shore Railway Company has been incorporated. The incorporators are James H. Van Vlissingen, John E. Colnon, William C. Heinroth, Frank S. Read and Louis F. Nafis. The capital stock is $100,000.

AKRON, OHIO—The Akron Street Railway Company is figuring to make an extension of their line to Barberton.

JACKSON, MISS.—The City Council of this place has granted a franchise to build five miles of electric railroad and a light plant to Gen. S. T. Carnes, of Memphis, and H. H. Corson, representative of the General Electric Company, of Schenectady, N. Y. Work on the railroad is to begin in 60 days and on the light plant in five months.

New Telephone and Telegraph Companies.

GAPLAND, MD.—The Gapland Telephone Company has been incorporated by John Ahalt, Hamilton W. Shafer, George C. Huffer, George S. Huffer and T. B. Biser, to build and operate telephone and telegraph lines.

JAMESTOWN, MINN.—The Jamestown Telephone and Telegraph Company's local telephone exchange has been purchased by the Northwest Telephone Exchange Company, of Minneapolis.

KINGSTON, TENN.—The East Tennessee Telephone Company will establish a telephone exchange.

MILFORD, DEL.—A telephone line is being constructed from Milford to the light-house at the mouth of the Mispillan River.

WHARTON, TEX.—A telephone line is being constructed.

PHILADELPHIA, PA.—A company has been organized to put up a telephone line between Arlington and Fossil, Gilliam County.

HUNTINGDON TENN.—The Carroll County Telephone Company has been incorporated by L. P. Clark, A. M. Lee, C. B. Dalton, J. C. R. McCall and J. McN. Wright.

FLINTVILLE, TENN. — Telephone line will be constructed, connecting Flintville, Oregon and Smithland with Fayettville.

ELDORA, COLO.—A long-distance telephone line is to be established.

WATERLOO, ILL. — Harrisonville Telephone Company has certified to an increase in capital stock from $8,000 to $20,000.

CANTON, S. D.—The Canton Telephone Exchange Company has been organized, and the following men elected as officers: Charles E. Judd, president; M. L. Lyverud, vice-president; F. H. Bacon, secretary; C. M. Seely, treasurer. The company will put in a local exchange and has secured the franchise ahead of the Northwestern Telephone Exchange Company. A line will also be run to Moe, Alcester and Beresford.

LITITZ, PA. — The Independent Telephone Company has been incorporated; capital, $25,000.

CAMBRIDGE CITY, IND.—The Citizens' Telephone Company has been incorporated, with a capital stock of $10,000.

WATERBURY, VT.—The New England Telephone and Telegraph Company are placing another direct telephone line from Montpelier here.

STELLA, NEB. — The Interstate Telephone Company, of St. Joseph, has completed arrangements to give this place connections with their line now being pushed from St. Louis to Omaha. They will probably buy the Falls City local line, which is nearly completed to this point.

INDUSTRIAL NOTES.

The Electrical Exchange, Chicago, is making a special drive on some high grade lamps, selling them at a very low price. In order to attract local trade one of the company's show windows has been filled with a lot of lamps, the whole being illuminated by colored bulbs.

The Diamond Rubber Company, of Akron, Ohio, has prepared neat catalogues illustrating and describing its complete lines of mechanical rubber goods, belting, hose and packing. This company's manufacturing facilities have recently been largely increased and the company reorganized.

The Chicago Armature Company is preparing to take good care of the approaching rush of repair orders which always follow the season of thunder-storms and other electrical disturbances in spite of the best lightning arresters. The fact that the company is gaining new customers constantly would indicate that its work must be of a very satisfactory character.

The Central Electric Company announces an increased demand for all kinds of house goods, particularly for its new extra "B. B." iron-box bell, which it introduced recently. It is also noted that the new forms and types of electric heating and cooking appliances, handled by the company, are fast passing from the class of expensive luxuries to the larger sphere of household necessities.

The American District Steam Company, Lockport, N. Y., has installed a system of underground steam plants for heating, in connection with the central stations, in the following cities, among others: Springfield, Ill.; Grand Rapids, Mich.; Terre Haute, Ind.; Ottumwa, Iowa; Danville, Taylorville, Ill.; Tiffin, Ohio; Newburgh, N. Y.; St. Joseph, Mo.; Topeka, Kas.; Fredonia, N. Y.; Davensport, Burlington, Muscatine, Iowa. The system is worthy of consideration by all progressive central station plants, as it contains the possibilities of increased dividends.

The Wilday Electrical Engraving Machine Co. will exhibit at the Electrical Exposition the Wilday electrical engraving machine. It is the invention of Mr. J. H. Wilday, and is said to have many advantages over the old style of engraving by hand. A name can be engraved on any kind of metal in 15 seconds against the old time of 30 minutes. The machine is compact in every way, and any one with a little experience can operate it and beautiful work can be done with a little practice on the part of the operator. The cost of running the machine is from 50 to 75 cents per week, and it can be run from batteries or the current can be taken direct from the incandescent circuit. The speed can be made high or low at will and the machine can be run at a great rate of speed and thereby, in case it is found necessary, turn out work very rapidly.

Nature of Cathode Radiation.

It will give pleasure to certain British and Irish physicists to see that the discoverer of the "Lenard Rays" has arrived at a conclusion respecting the nature of cathode rays which is nearly identical with their own, says the London *Electrician*. P. Lenard has made a variety of new experiments with extremely exhausted "observation spaces," and found that, in every case, the rays behaved like moving negatively charged matter endowed with inertia. When the cathode rays, after emerging from the aluminum window, impinge upon a plate connected with an electroscope, a negative charge is at once indicated. This charge, it should be stated, is observed even when the aluminum window is put to earth, and the gas in the observation space is so highly exhausted as to be unable to convey even a strong electric discharge. When the rays pass midway between two condenser plates the condenser loses none of its charge, even if that is high. When the condenser is uncharged the beam proceeds in a straight line. When the condenser is charged the beam is curved in such a manner that its hollow side is turned towards the positive plate, and the phosphorescent patch is displaced in that direction by an amount which varies with the strength of the field. The rays which are more subject to magnetic deflection are also more subject to electrostatic deflection. Their speed of propagation is about one-third of that of light. These results are very valuable and significant.

LITERARY.

A war poem by Rudyard Kipling, especially apposite to the present crisis, will appear in *McClure's Magazine* for May. It is described as treating, with all of Kipling's wonderful sweep and subtlety, of the torpedo, with its "strength of twice three hundred horse"—

"The doom-bolt in the darkness freed—
The mine that splits the main."

"Want Ads." and employment bureaus, in their relation to the day laborer out of a job, are depicted in the May instalment of "The Workers" in *Scribner's*.

Kindred.... ...Interests

The Illinois Steel Company, the Rookery, Chicago, has issued a profusely illustrated booklet describing its many extensive and modern plants for the manufacture of steel. The various plants of the company are interestingly described. A perusal of this booklet will be profitable to any one concerned with the uses of iron or steel.

The Standard Thermometer and Electric Company, Peabody, Mass., have issued a neat pamphlet illustrating and describing the Upton "Midget" enclosed arc lamps for all circuits. The information contained is valuable to lamp users, and the illustrations give a correct idea of the construction and operation of these popular lamps.

De Veau & Company, telephone manufacturers of New York, recently received an order from the government for telephones for a merchant ship which is to be fitted up for a war ship. This company recently moved to 27 Rose street, into greatly enlarged quarters, and is quite busy manufacturing its excellent line of telephone apparatus and supplies.

A very attractively gotten up catalogue has just been issued by the Holtzer-Cabot Electric Company, of Boston, Mass., illustrating their telephone apparatus, magneto bells, power generators, etc. The book is one which everybody who has any connection with telephone matters should have, as the Holtzer-Cabot apparatus is recognized as standard throughout the telephone field.

The Gold Car Heating Company, of New York, proposes to exhibit at the coming Electrical Exhibition in New York city the most complete line of electric heaters ever shown. This company manufactures improved devices for heating cars, houses, boats and buildings, and their exhibit will comprise some 50 different styles and sizes of electric heaters and will be a unique and interesting feature of the exhibition.

The Standard Telephone and Electric Company, Madison, Wis., of which Mr. J. J. Nate, an experienced and energetic telephone man, is general superintendent, is doing an excellent business and receiving a great many large orders for telephone apparatus from different parts of the country. During the last 10 days this company has sold apparatus to some 15 new exchange companies. The apparatus of the standard company is winning favor wherever it is tried.

Mr. W. D. Garton, 414 Ashland Block, Chicago, has completed arrangements with the United Electric Improvement Company, of Philadelphia, and will hereafter represent them in Chicago in the sale of their products. He will specially push their high-grade incandescent lamps. The United Electric Improvement Company, as is well known, manufacture all kinds of generators and motors for direct and alternating currents, as well as transformers, lamps and sockets.

Eugene Munsell & Company, of New York and Chicago, are enjoying an excellent trade on their India and amber mica segments for railway motors. Several heavy orders have recently been received, one of which was probably the largest ever taken for mica segments from an electric railway. It consisted of more than 800 pounds of the India and amber segments. The firm carry a large stock of mica, both in the sheet and cut to size; and have unexcelled facilities, both at New York and Chicago, for executing orders promptly. They will take pleasure in sending samples for trial to any electrical manufacturer, repair

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concern, or street railway who may write them requesting same.

An alternating-current cored carbon, which is the result of a long series of experiments, is now offered to the electric lighting interests by the Washington Carbon Company, Pittsburgh, Pa.

An improved series of motors and dynamos of from 1 to 20 horse-power is now being constructed by the Rochester Electric Motor Company, at their new factory, corner Mill and Platt streets, Rochester, N. Y.

The new form of junction box, made by Pass & Seymour, Syracuse, N. Y., is a radical departure from the junction boxes heretofore made. Pass & Seymour, as is generally known, manufacture a comprehensive line of porcelain insulating specialties.

The Reading Electrical Manufacturing Company, of Reading, Pa., are equipping a new factory. This company are manufacturers of a number of electrical specialties, including pocket volt meters and ammeters, electric bicycle lamps and spark coils.

The sale of the "Crescent" ceiling fans since January 1, 1898, has already reached the 1,000 mark, according to general manager D. H. Kulp, of the Marietta Manufacturing Company, the makers. The Western Electric Company are the agents in the West for the "Crescent" fans.

A new quick-brake switch has recently been put on the market by the Demary Quick-Break Switch Company, Erie County Bank Building, Buffalo, N. Y., which has several features likely to recommend it for general adoption. It has had the endorsement of the Board of Fire Underwriters.

The Williamsport Wooden Pipe Company, manufacturers of wooden conduit made under the "Chestnut" patent, are preparing their factory for a very active season. It is said that 500 miles of their conduit is now in successful use in the city of Philadelphia, and is rapidly being introduced into other large cities.

One of the most complete series of telephone instruments yet perfected by an independent company is now ready for mercantile introduction by the Pennsylvania Electric Company, Marietta, Pa. The apparatus is largely the design of Mr. Paul W. Bossart, a gentleman of many years' practical experience in the telephone world.

As still another indication of the greatly improved business conditions throughout the Middle West, the Weston Engine Company, Painted Post, N. Y., speak of a largely increased output of Weston engines during the past weeks, in fact, their new shops are operating practically to their capacity. This company is one of the pioneer manufacturers of engines, which has kept thoroughly in touch with the progress in engine design.

The Wilhelm Telephone Company, Buffalo, N. Y., are soon to move into a large factory, which is now being equipped with the most modern apparatus for producing telephone instruments. This company has had remarkable success with the sale of their apparatus, and the move is made because the demand has increased to such an extent that they are unable to produce fast enough to meet the demand with their present facilities.

The Cross Electrical Company, electrical engineers, recently organized in Buffalo, N. Y., has established a pleasant suite of offices in the Mooney-Brisbane Building. Aside from the private offices, the company will maintain a large exhibition room for showing electrical machinery and apparatus, for which they may be agents. In addition to the engineering work, the company is now equipping a factory for refilling incandescent lamps.

"Electric Motors in the Art of Printing" is the title of a brochure just issued by the Sprague Electric Company, 20 Broad street, New York city. It is an unusual example of typographical excellence and effectively accomplishes the object attempted. Another bit of artistic printing, emanating from the same company, is called "Lundell Fan Motors, 1898 Models." One or both these pamphlets may be obtained by addressing the company as above.

The Warren Electric and Specialty Company, Warren, Ohio, have just issued a circular statement to the effect that the practice of refilling lamps has been discontinued in their factory, and as their supply of refilled lamps has been exhausted they offer only new incandescent lamps. This company now carries a stock of incandescent lamps at their Chicago office, 167 Dearborn street. The Chicago branch is under the management of Mr. W. S. Hull.

The "Tuerk" alternating-current ceiling fan, made by the Hunter Fan and Motor Company, Fulton, N. Y., has a number of improvements in construction and finish for the '98 pattern, as described in the ELECTRICAL REVIEW some weeks ago. This ceiling fan is generally accepted as a standard for alternating current in this line of apparatus. E. B. Latham & Company, 136 Liberty street, New York, are sales agents for the East, and the Western Electric Company for the West for this apparatus.

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NOTICE TO CONTRACTORS — SEALED proposals for furnishing the materials and performing the labor required and necessary for installing the electric light wiring for the eastern approach, porticos and lobbies, and completing the electric wiring for the western staircase and fifth story of the state library; also for furnishing the electric light fixtures for the eastern approach, lobbies, porticos and western staircase, for the State Capitol at Albany, N. Y., may be sent by mail or delivered in person up to 12 o'clock noon on the 29th day of April, 1898, to the undersigned at his office in the Capitol, Albany, N. Y.

Only the bids of parties or firms actually engaged in electrical construction work and in the manufacture of electric light fixtures will be considered, and bidders must be able to refer to work similar in character, performed by them elsewhere.

Separate proposals must be made for the electric wiring and for the fixtures, and must be accompanied by a certified check or New York draft for a sum equal to ten per cent of the amount of such proposal to guarantee execution of contract, payable at sight to the order of the Superintendent of Public Works. Said deposit will be retained as a part of the security until the completion of the contract. The amount of bond for the faithful performance of contract, on execution of contract, will be forty per cent of the proposal or proposals, and the amount of labor bond required on execution of contract will be thirty per cent of the proposal or proposals.

The work is to be done with all the speed compatible with good workmanship, and the contractors are required to state the time within which they will bind themselves to complete the work, as the element of time will be considered by the Superintendent of Public Works in awarding the contract.

Drawings and specifications may be seen and blank forms of proposals obtained at the office of I. G. Perry, Capitol Commissioner, in the Capitol, at Albany, N. Y.

Original designs for electrical fixtures, together with plans and specifications, and proposals for furnishing same, as substitute for designs shown as above stated, will be received and given consideration.

The undersigned reserves the right to reject any or all bids as he may deem for the best interest of the state.

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Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED APRIL 12, 1898.

602,076 Cotton-picking machine; T. H. Price, New York, N. Y.—In a cotton-picking machine, the combination of a rotating generator of electricity, and a rotating collector moving at a different speed from said generator, and located in inductive relation thereto so as to be charged therefrom by induction.

602,142 Supply system for electric railways; P. J. Pringle, London, England.

602,172 Secondary battery; F. W. Schneider, Triberg, Germany—In combination, the supporting frame, consisting of the parallel perforated plates of insulating material with the spacing tubes and connecting bolts, and a series of electrode elements piled in the space between the plates and resting upon the spacing tubes.

602,174 Telephone transmitter; H. E. Shreeve, Boston, Mass.—The combination in a telephone transmitter, with a diaphragm carrying both electrodes, one mounted directly thereon and the other through an interposed elastic arm or plate; of a mass of granular carbon held between and in contact with the said electrodes to constitute a variable resistance medium, the grains or particles of carbon being spherical or rounded in form.

602,176 Storage battery; G. A. Washburn, Cleveland, Ohio—A storage-battery electrode, having on each side a series of groups of concentric ring-shaped projections of substantially uniform cross section one with the other, and equally spaced at all points to hold active material between them and standing out above the adjacent surface of the plate, and a hole centrally through each group communicating with the opposite side of the plate.

602,208 Electric block system; F. Burger, Fort Wayne, Ind.

602,218 Electric transformers; L. Guttman, Pittsburgh, Pa.—A core element for electric transformers, consisting of a plate or lamina of magnetic material, two or more recesses in said plate, a second plate adapted to bridge said recesses and means for interlocking the said plates.

602,325 System of electric propulsion for vessels; J. J. Heilmann, Paris, France.

602,336 Conductor and contact device for electric railways; A. S. Krotz, Springfield, Ohio—A contacting device for third-rail electric railway systems, the same comprising a suitably formed body portion or frame, having a shoe, a block pivoted thereto, and a resilient supporting piece connected with said block.

602,362 Galvanic battery; W. Rowbotham, Birmingham, England—In a hermetically sealed electric battery, consisting of the depolarizing liquid compartment and the liquid expansion chamber, located in juxtaposition to one another within the sealed battery, the tubular carbon elements communicating with said expansion chamber.

602,380 Electric arc lamp; E. Weber, Paris, France—The combination, with a frame of an electro-magnet, a magnetic disk in the field of said magnet, a brake for the disk, an armature co-acting with the magnet and controlling the brake, a magnet serving to retard the revolution of the disk, and a carbon holder having connections with the disk.

602,404 Electric arc lamp; J. Mueller, Cleveland, Ohio.

The Huntsville, Tenn., Electric Light Company is building a new plant at a cost of $12,000.

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TRADE NOTES.

A. O. Schoonmaker, 158 William street, New York, calls attention to his solid sheet mica segments which he is prepared to furnish to any pattern wanted. Each sheet is stamped to the full size of the segment, thus insuring perfect insulation. He will be pleased to furnish samples to any one wishing to give them a trial.

One of the latest electric elevator contracts awarded the Sprague Electric Company is for an outfit of 10 machines for the Commerce Realty Building in St. Louis. Says a St. Louis contemporary: "This installation represents a distinct advance in St. Louis in modern installations of this character, and its performance will be watched with interest." A large number of out-of-town contracts have been recently awarded the Sprague company.

The Armington & Sims Company, of Providence, R. I., have just issued a very attractive catalogue of their high-speed automatic cut-off engines. As is well known, the Armington & Sims high-speed engine, 1898 pattern, is a modern piece of machinery and embodies the devices and improvements which long experience has brought to the highest efficiency. The exacting requirements of electric railway and electric lighting service call for engines of massive construction with the metal distributed so as to insure absolute rigidity throughout. All these essentials are to be found in this engine. The catalogue is thoroughly illustrated and contains the various sizes, with a code word for ordering. A number of illustrations of direct-connected engines are also presented. The catalogue will be a valuable addition to every power user.

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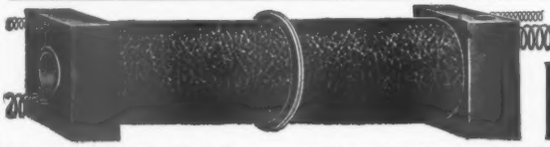
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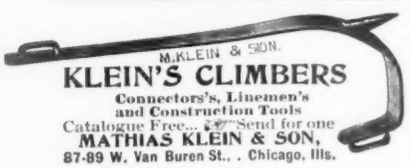
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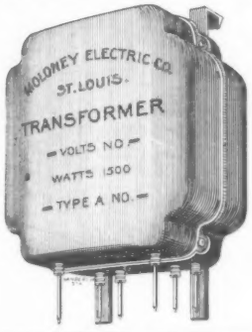

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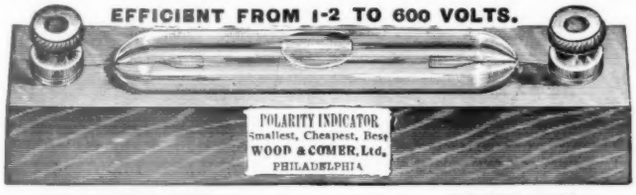

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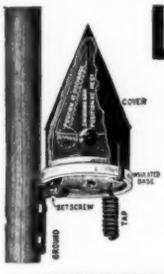

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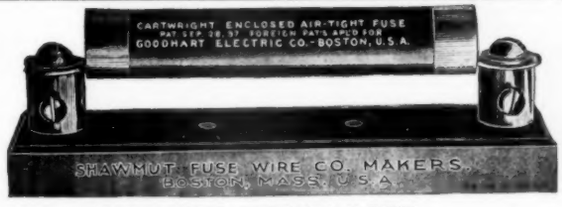
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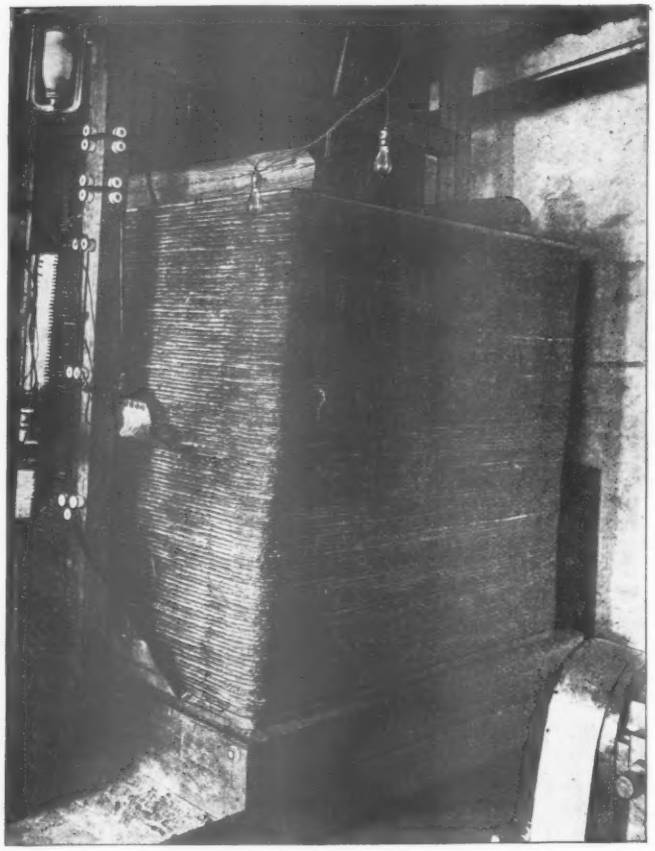

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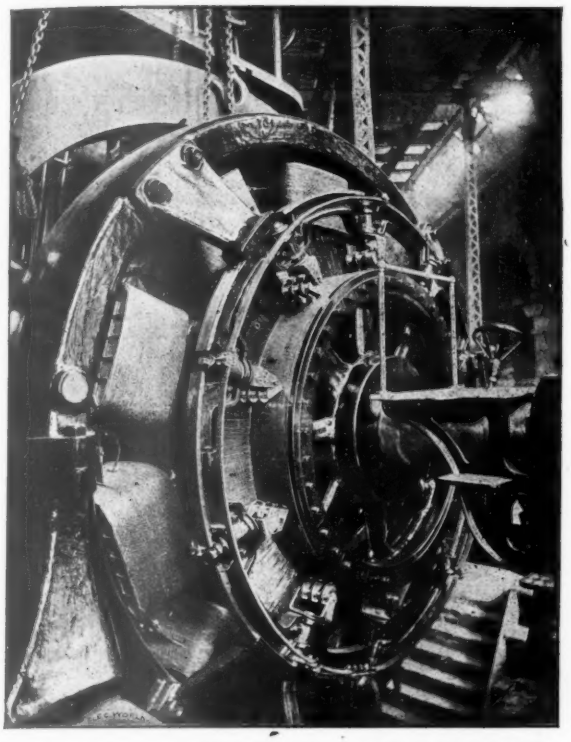

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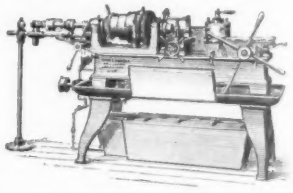

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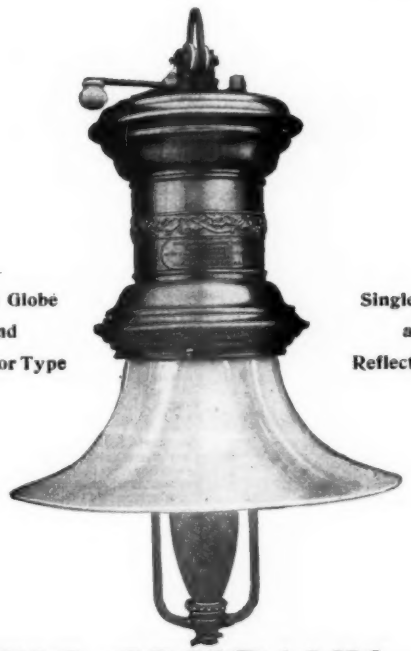

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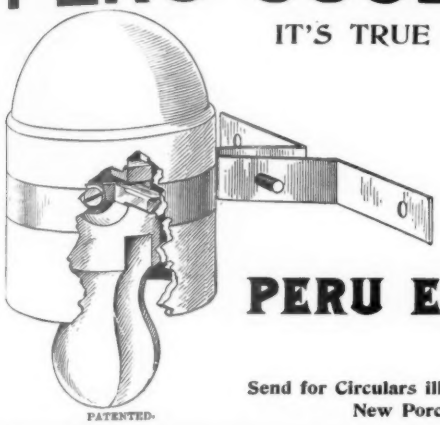
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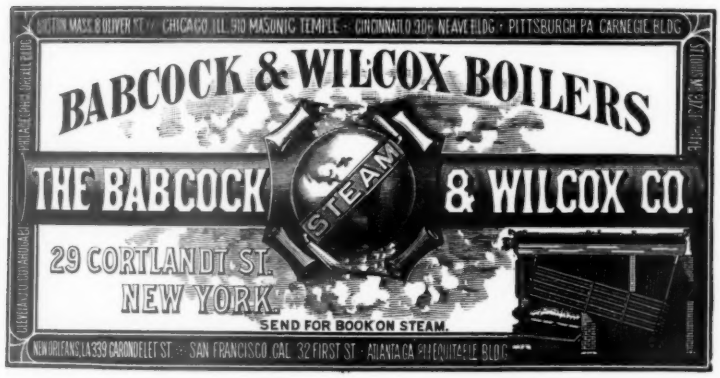
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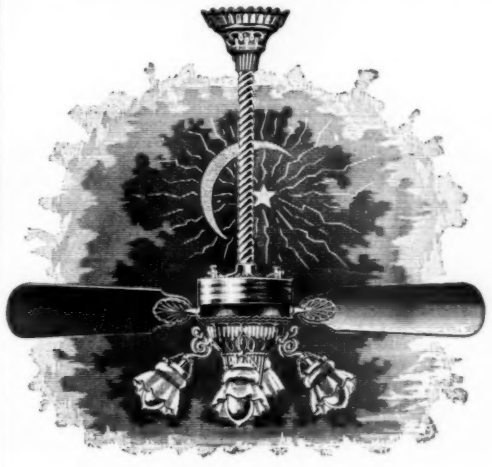

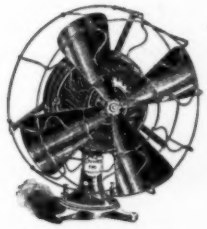
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